First Annual Report

OF THE

Watuppa Water Board,

TO THE

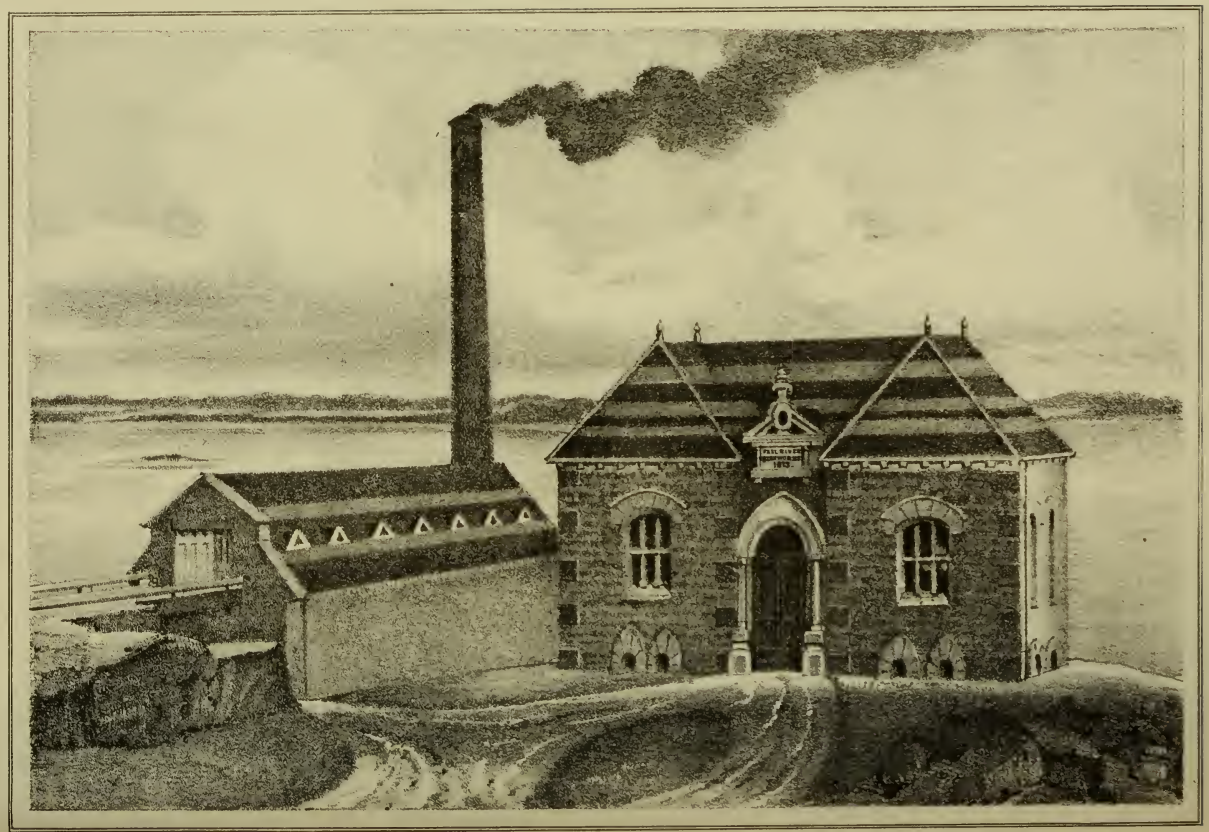
City Council

OF THE

City of Fall River,

JANUARY 1st, 1875.

FALL RIVER, MASS.
FISKE & MUNROE, STEAM BOOK AND JOB PRINTERS,
1875.



B. Enell & Son, 7 Granite Block, Fall River, Mass.

ENGINE HOUSE.

FALL RIVER WATER WORKS.

REPORT

OF THE

WATUPPA WATER BOARD

TO THE

City Council,

CONTAINING

1st. The History of the Works, and Operations of the Water Commissioners and of the Watuppa Water Board, previous to Jan. 1, 1875.

2d. The Report of the Water Registrar.

3d. The Report of the Engineer and Superintendent, giving a description of the Works.

JANUARY 1, 1875.

FALL RIVER, MASS.:
FISKE & MUNROE, STEAM BOOK AND JOB PRINTERS.
1875.

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ORGANIZATION

OF THE

FALL RIVER WATER WORKS.

WATUPPA WATER BOARD.

PHILIP D. BORDEN, President, (term expires May 1, 1877).
WILLIAM LINDSEY, (term expires May 1, 1876).
JOHN BUTLER, (term expires May 1, 1875).

CHARLES H. CHURCHILL, Clerk and Water Registrar.
WILLIAM W. ROBERTSON, Assistant Clerk.

WILLIAM ROTCH, Engineer and Superintendent.
WILLIAM B. SHERMAN, Assistant Engineer.
WILLIAM CARR, Jr., Assistant, Engineering Department.
EDWARD L. ANTHONY, Assistant, Engineering Department.
PATRICK KIERAN, Superintendent of Pipe work.

JOHN LUFKIN, Pumping Engineer.
WILLIAM H. LUFKIN, Assistant Pumping Engineer.

REPORT.

CITY OF FALL RIVER.
OFFICE OF THE WATUPPA WATER BOARD,
January 1, 1875.

To the City Council of the City of Fall River:

GENTLEMEN—

By the 17th Section of the "Ordinance to provide for the establishment of the Watuppa Water Board, and for the care and management of the Fall River Water Works," passed March 30th, 1874, it is provided that "the Watuppa Water Board shall, on some day during the month of January, annually, place in the hands of the Mayor a report to the City Council; which report shall contain, in addition to the report to the Board from the Superintendent, a full statement of the operations of the Board, and a detailed account of the receipts and expenditures for the year ending on the last day of December next preceding. Also a statement setting forth the cost of each branch of the works up to that time, and a schedule of the lands and other property belonging to the city and connected with the works. And it shall be the duty of the Board in their annual report, to lay before the City Council all such information, and to make all such suggestions as may be deemed needful in connection with the condition and operation of the Works."

The Water Commissioners having made their monthly reports to the Standing Committee of the City Council on water, as required by the Ordinance of May 8th, 1871, and this being the first report of the Watuppa Water Board to the City Council in conformity to the Ordinance of March 30th, 1874, it will be necessary, in order to comply fully with the Ordinance, to trace briefly the history of the enterprise from its beginning.

Jan. 3d, 1870, Mayor Samuel M. Brown, in his inaugural address, called the attention of the City Council to the importance of supplying the city with pure water by means of aqueducts, and Jan. 7th, the Joint Special Committee on the Mayor's Address, consisting of Joseph A. Bowen, Simeon Borden, Joel Wood, Bradford D. Davol and Holder B. Durfee, recommended "that so much of the Mayor's Address as relates to the subject of introducing pure water be referred to a Joint Special Committee, to consist of two members of the Board of Aldermen and three members of the Common Council."

This recommendation having been adopted in both branches of the City Government, the following Committee on the introduction of water was appointed:—

Joseph A. Bowen,
James E. Cunneen,
Andrew Luscomb,
Joseph M. Darling,
Holder B. Durfee.

Aug. 3d, 1870, this Committee presented their report, which was approved and published, and the Committee was further authorized to cause surveys to be made and to continue investigations.

Annexed to the report of the Committee was a report from Prof. John H. Appleton, stating that a careful analysis of a sample of the water from North Watuppa Pond showed but 1.80 grains of solid matter per gallon, and that the purity of the water, its freedom from objectionable salts and remarkable softness "render it eminently suitable for the various purposes of a water supply, for drinking, for washing, for use in steam boilers, and for general manufacturing purposes where a pure and soft water is required."

Nov. 29th, 1870, the Committee on Water Supply, being duly authorized by the City Council, purchased of Jonathan and William L. Slade, a tract of land situated on the borders of North Watuppa Pond at the head of Bedford st., and containing 48 45-100 acres for the sum of $21,000.

Jan. 18th, 1871, the Committee received from Hon. Wm. J. McAlpine, C. E., a comprehensive report on the Water Supply of Fall River, and suggesting a general plan for the construction of the proposed Water Works.

March 23d, 1871, an act was passed by the Legislature of Massachusetts, authorizing the city to introduce water whenever a majority of the qualified voters of the city should decide in its favor, and at an election, held April 10, 1871, there were

933 votes in the affirmative and 89 in the negative, and the Act was declared approved.

May 8th, 1871, the two branches of the City Council met in joint convention for the choice of three Water Commissioners, and Philip D. Borden, William Lindsey and Joseph A. Bowen were elected for three years. On the same day an Ordinance was adopted, regulating the duties of the Water Commissioners.

May 15th, 1871, the Water Commissioners held their first meeting and organized by the choice of Philip D. Borden as President of the Board, and William Lindsey as Secretary.

May 22d, 1871, it was voted to secure the services of George A. Briggs, as Chief Engineer, and he entered upon his duties on the first of June.

June 12th, William Rotch was employed as Assistant Engineer, and James P. Kirkwood was engaged to act as Consulting Engineer for eighteen months from July 4th.

The Water Commissioners, before deciding upon any particular plan for the construction of the works, visited several cities to examine the various methods of supplying water, and finally decided to adopt the plan of pumping directly into the mains with a small stand pipe to serve as a cushion, and to relieve the engine and distribution pipes, in case a large number of hydrants should be suddenly closed at the same time.

PUMPING ENGINE.

April 30th, 1872, a contract was made with the Boston Machine Co. to build and place upon foundations furnished by the city a double engine, so arranged as to work together or separately, as desired. The diameter of the steam cylinders is 28 inches; of the water cylinders, 16 inches; and the stroke of both is 42 inches.

The engine is a plain, substantial piece of work, and does credit to the builders; the fact that one or both of the engines may be worked at variable speeds, to adapt themselves to the varying quantities of water required by the city at different hours of the day, adds much to their value.

In the duty performed—or the quantity of water raised one foot high for every pound of coal burned—the engine does not come fully up to the requirements of the contract, but the capacity exceeds what was guaranteed, for the contract stipulated that the engine should deliver 3,000,000 gallons in 24 hours, at a speed of 16 revolutions per minute, while the results of careful weir measurements, under the direction of Mr. James B. Francis, of Lowell, showed a capacity at this speed of 3,168,000 gallons, and at the maximum speed of about 24 revolutions per minute, the engine is capable of delivering 4,750,000 gallons in 24 hours.

ENGINE HOUSE, ETC.

The Commissioners, in the erection of an engine house, boiler house and coal house, built much

larger than the present wants of the city demand. The engine house is 80 ft. by 56 ft. in the clear, and 34 feet high, which was intended to furnish room for four engines, and the house was built of this height in order to give ample room for a vertical engine, if wanted, without alteration of the building.

The boilers—two in number—were included in the contract with the Boston Machine Co. They are vertical, fire-box boilers, seven feet in diameter, with 220 tubes in each, the tubes being ten feet in length, two and one-half inches in diameter.

The chimney is 112 feet high, which gives a very strong draught.

The natural formation of the ground near the coal house makes it easy for the coal to be unloaded from the carts, at a height of 23 feet above the floor, without extra shovelling, and in the construction of the road over the hill, the highest point was cut down about ten feet, leaving the grade on the eastern slope 8 8-100 feet per 100, and on the western slope 4 85-100 feet per 100. This extra expense in the construction of the road was considered better, and in the end more economical, than to haul all the coal over a heavier grade for all time.

The pumping station being more than half a mile from the nearest houses, it was necessary to build a dwelling house for the engineers, in the vicinity of the engine house. As there was a great abundance of granite close at hand, a substantial

building was erected of this material, about 265 ft. west of the engine house, containing two large and convenient tenements for the families of the pumping engineer and his assistant. A portion of the basement was arranged for a store house for the Water Works.

The engine was first started on the 5th of January, 1874; and on the 8th the water was in the mains as far as Main Street.

On the expiration of the Commissioners' term of service, May 8th, 1874, about twelve miles of cast iron water pipes had been laid, and 100 service connections had been attached. Up to that time the total amount expended by the Water Commissioners was $582,947.62.

On the 8th of May, 1874, the term of the Water Commissioners had expired, after which the Trustees of the Watuppa Water Board, consisting of Philip D. Borden, elected for three years; Wm. Lindsey, elected for two years; and John Butler, elected for one year, met and organized by the choice of Philip D. Borden as President, and Charles H. Churchill as Clerk and Water Registrar.

Nov. 13th, 1874, a contract was made with Henry R. Worthington, of New York, for a Duplex pumping engine for the "High Service," with a capacity of 5,000,000 gallons in 24 hours, at a piston speed of not more than 110 feet per minute.

Dec. 8th, Mr. Briggs, after a service of more than three years, tendered his resignation, to take

effect Dec. 31st, 1874, and on Dec. 31st William Rotch was elected Chief Engineer and Superintendent, and William B. Sherman was elected Assistant Engineer.

In the following statement will be found an account of the receipts and expenditures in the various departments, from the commencement of the work up to the first of January, 1875:—

RECEIPTS.

Cash received from the City,	$828,358 70
Water Meters,	1,742 50
Hoisting Engine,	475 00
Pipes sold to corporations, for fire purposes,	1,316 89
Labor on vessel,	11 20
Lead,	43 02
Stone,	674 11
Sand,	35 00
Total Receipts,	$832,656 42

EXPENDITURES.

Cast iron water pipes,	$346,186 44
Earth and rock trenching, laying pipes, etc.,	162,573 64
Service pipes,	16,706 29
Road on Reservoir Lot,	20,393 40
Pipe trench on Reservoir Lot,	16,196 65
Stand Pipe,	791 75
Excavation for stand pipe and weir,	748 75
Filling coffer dam, grading around engine house, etc.,	6,701 91
Clearing Reservoir Lot, etc.,	1,045 79
Engine House, Boiler House, Coal House, Chimney, etc,	79,842 32
Foundations for the same,	20,729 03
Coffer dam and conduit,	8,709 61
Hydrants, stop-gates and air cocks,	43,360 47
Engine (including payments up to Dec. 31, 1874),	27,600 00
Running Engine,	9,365 77
Dwelling House, (including store room in basement)	21,559 49
Engineering Department,	32,193 47
Salaries of Water Commissioners and Clerks,	11,257 64
Incidentals,	2,227 65
Total expenditure,	$828,190 07
Cash on hand Jan. 1, 1875,	4,466 35
	$832,656 42

REVENUE FOR 1874.

The ordinance of March 30th, 1874, provided that "the City Council shall annually make an appropriation of $20,000 as a full equivalent for the unlimited use of water by the City for all public purposes."

During the remainder of the year, subsequent to the date of the ordinance, the proportional amount to be paid by the city is $15,000. Adding this to the amount received by the Water Registrar ($9,336.95) will make the total revenue for the first year $24,336.95.

The table in the report of the Water Registrar shows that fifty taps have been inserted during the last year for water used for public purposes by the City, and the report of the Engineer shows that 227 hydrants have been provided for the use of the Fire Department.

CAST IRON PIPES.

The first contract for cast iron pipes was made Dec. 15th, 1871, with R. D. Wood & Co., of Philadelphia, and the total amount of pipes and special castings ordered from them was 3853 tons.

Jan. 29th, 1874, a contract was made with John McNeal & Sons, of Burlington, N. J., and the total amount ordered was 1406 tons.

June 15th, 1874, 272 tons were ordered from the Warren Foundry and Machine Co., Phillipsburg, N. J., and July 21st, 1874, 856 tons were ordered from the Gloucester Iron Works, of Gloucester City, N. J.

The total amount of straight pipes already ordered is 6081 tons, making a length of 27 1-2 miles, and the weight of the special castings ordered is 306 tons, or about 5 per cent. of the straight pipes. The average price paid for the whole amount is $54.19 per ton, the prices ranging from $42.91 to $58.69 for the straight pipes, and from $64.29 to $95.20 for the special castings. The above prices include the cost of delivering the pipes on the wharf at Fall River.

With few exceptions, the pipes have been well made; some of the branches, however, made under the first contract, did not conform to the specifications and were rejected, others being sent to supply their place. A careful inspection, both at the foundry and on the wharf at Fall River, prevented any imperfect castings from being accepted or paid for.

The Water Board recommends that immediate action be taken by the city to purchase a strip of land along the west shore of North Watuppa Pond, from the New Boston Road, near the Ice Houses, to the "Narrows," so called, of sufficient width to build a road and construct a sewer, in which to collect the wash from the east slope on the west side of the pond, and deliver the same into the South Pond at the "Narrows," in order to prevent any impurities from entering the waters of the North Pond by the occupation of the lands for dwellings, etc.

In the construction of the Water Works, it has been the aim of the Water Board that every-

thing should be done in the most substantial manner, with a view to the future growth of the city, and at the same time with the observance of all proper economy; the experience of the Board up to the present time has shown no essential point in which they would recommend any change from the plan that has been followed, and yet they cannot consider the Water Works complete, until a reservoir is constructed on the hill at the head of Bedford St., with a capacity sufficient to supply the city for ten days or a fortnight, in case any accident should happen to one or more of the engines, or in case a boiler explosion should cut off the supply of steam—contingencies which, it is true, may never happen, but which true economy and wise forethought cannot but consider and guard against.

Moreover, a large and long continued conflagration might, for a time, require the engine to run at a higher speed than economy or safety would warrant, so that the liability to accident would be greatest at the very time when the water was most needed.

The difficulty of obtaining suitable material for the reservoir embankments, and the probability that a large amount of ledge would have to be excavated, as well as a desire to introduce the water into the city at the earliest possible moment, led to the postponement for a time of the construction of a reservoir; and the low prices at which labor of all kinds can now be obtained will make the total cost much less than it would have been two or three years ago.

Inventory of Stock and Tools on hand January 1st, 1875.

CAST IRON PIPES AT MECHANICS' MILLS WHARF.

No. of Pieces.	Diameter in Inches.	CLASS.	LENGTH of each class.	LENGTH of each size.
3	24	A	7	191
19	24	B	184	
6	20	A	70	823
29	20	B	318	
1	20	C	12	
37	20	D	423	
6	16	B	69	328
23	16	C	259	
21	12	B	9	231
19	12	D	222	
48	10	A	560	2,078
5	10	C	18	
130	10	D	1,500	
92	8	A	1,034	1,905
2	8	C	15	
79	8	D	856	
43	6	A	495	10,292
763	6	B	8,755	
91	6	C	1,014	
9	6	D	28	

Total, 1426 pieces straight pipe, 15,848 ft.

Total length, 15,848 feet, or 3 miles.

BRANCHES.

2	8 on 24	3 way	B	2	6 on 10	3 way	C
2	6 on 24	3 way	B	8	6 on 10	3 way	D
1	12 on 20	3 way	B	1	6 on 10	4 way	D
1	8 on 20	4 way	B	1	8 on 8	4 way	A
1	6 on 20	3 way	B	1	8 on 8	3 way	D
1	16 in Y		C	8	6 on 8	3 way	A
1	8 on 16	4 way	B	8	6 on 8	4 way	A
1	6 on 16	4 way	A	4	6 on 8	3 way	B
2	6 on 16	3 way	B	6	6 on 8	4 way	B
3	6 on 16	4 way	B	2	6 on 8	4 way	C
1	12 on 12	3 way	D	3	6 on 8	3 way	D
1	8 on 12	3 way	B	20	6 on 6	3 way	A
2	6 on 12	4 way	B	8	6 on 6	4 way	A
3	6 on 12	4 way	C	43	6 on 6	3 way	B
1	6 on 12	3 way	D	14	6 on 6	4 way	B
1	6 on 12	4 way	D	13	6 on 6	3 way	C
1	8 on 10	4 way	C	4	6 on 6	4 way	C
1	8 on 10	4 way	D	15	6 on 6	3 way	D
1	6 on 10	3 way	A	5	6 on 6	4 way	D
5	6 on 10	4 way	A				

DOUBLE HUBS.

1	24 inch	class A
3	24 "	" B
1	20 "	" B
3	16 "	" A
5	16 "	" B
1	16 "	" C
1	12 "	" D
3	10 "	" C
1	10 "	" D
2	8 "	" A
2	8 "	" B
2	8 "	" C
2	8 "	" D
7	6 "	" B
1	6 "	" D
—		
35		

BEVELLED HUBS.

9	20 inch	class B
2	20 "	" C
2	20 "	" D
3	16 "	" B
4	10 "	" B
8	10 "	" D
3	8 "	" A
8	8 "	" B
2	8 "	" C
2	8 "	" D
13	6 "	" B
11	6 "	" C
—		
67		

SLEEVES.

5	24 inch	Class A
4	24 "	" B
6	20 "	" B
6	16 "	" C
2	12 "	" B
2	12 "	" D
3	10 "	" C
6	8 "	" A
7	8 "	" B
3	8 "	" C
13	8 "	" D

QUARTER TURNS.

14	6 inch	class B
8	6 "	" D

EIGHTH TURNS.

4	12 inch	class B
2	12 "	" C
11	8 "	" B
3	8 "	" C
16	6 "	" B
5	6 "	" C

"CAPS" FOR BELL ENDS.

1	24 inch	class B
1	20 "	" B
3	16 "	" B
1	16 "	" D
1	12 "	" B
7	10 "	" D
15	8 "	" D
20	6 "	" D

"Bonnets" for Spigot Ends

1	16 inch	class A
1	12 "	" D
5	10 "	" D
8	8 "	" D
4	6 "	" D

GATES, HYDRANTS, ETC.

1	12 in. gate	class B
1	10 "	" B
1	10 "	" D
4	8 "	" C
1	8 "	" D
8	6 "	" B
8	6 "	" C
2	6 "	" D

9 gate frames
13 hydrants
1 hydrant box
4 air cock frames and covers
2 water posts
1 24 inch man hole, class B
500 ft. chestnut plank for gate boxes

CURVED PIPES.

3	16 in.	curved pipes,	class B
3	16 "	"	" C
1	20 "	"	" C

REDUCERS.

4 reducers 8 in. to 6 in. class B
1 " 10 " 8 " " A

AT ENGINE HOUSE.

1 large Stilson wrench
1 small " "
2 large monkey wrenches
1 small monkey wrench
1 set of wrenches for engine
1 ratchet
10 drills
1 screw driver
1 hammer
1 vise
1 small sledge
1 axe
1 hatchet
1 grind stone
1 platform scale
1 coal car
1 waste tank
2 dripping pans
1 "hydrant chuck"
1 pipe and nozzle
300 ft. of hose
3 dark lanterns
1 broom
2 funnels
2 quart measures
8 chairs
1 wash stand
1 bowl
1 pitcher
4 surveying staffs

AT TOOL HOUSE, ETC.

6 lead kettles
6 furnaces
6 lead ladles
2 stoves
1 Fairbanks' scale
1 large platform scale (at wharf)
3 large hydrant "chucks"
3 small " "
4 wheel derricks
4 triangle "
10 hoisting chains
7 "falls"
7 pairs of blocks
8 tool boxes
183 picks
102 shovels
28 crow bars
37 striking hammers
5 sledges
10 scrapers
8 dog chisels
10 hand drills
2 hand drilling hammers
6 cold chisels
30 calking "sets"
7 yarning irons
9 calking hammers
1 Stilson wrench
4 monkey wrenches
3 24 inch "clips"
2 20 " "
2 16 " "
2 12 " "
3 mattocks
2 axes
1 wooden mallet
1 chisel
4000 lbs. lead
1600 lbs. steel
16 eye bolts for caps
6 hook bolts for caps
2 hydrant wrenches
3 air cock "

11 gate wrenches
2 bales of packing for pipe joints
1 10 inch plug
25 8 inch plugs
60 6 " "
30 hydrant packings
3 20 inch rubber packings
6 16 inch rubber packings
5 12 " " "
5 10 " " "
30 8 " " "
35 6 " " "
6 water pails
76 lanterns
1 oil can

IN ENGINEER'S OFFICE.

2 drawing tables
2 writing tables
1 desk
1 chest of drawers
1 hat rack
1 letter press
6 chairs
2 stools
1 mercury gauge
Plans, drawing instruments, &c

IN OFFICE OF WATER BOARD.

1 safe
1 table
1 desk
8 chairs

ON HAND IN SERVICE PIPE DEPARTMENT.

2 tapping machines, with drills and other appurtenances
9 1 inch water meters
6 $\frac{5}{8}$ " " "
6 1 " taps
29 $\frac{3}{4}$ " "
28 $\frac{5}{8}$ inch taps
23 $\frac{1}{2}$ " "
12 1 " stops
7 $\frac{3}{4}$ " "
53 $\frac{5}{8}$ " "
17 $\frac{1}{2}$ " "
14 service boxes and covers

All of which is respectfully submitted.

PHILIP D. BORDEN,
WILLIAM LINDSEY,
JOHN BUTLER,
Trustees of the Watuppa Water Board.

Report of the Water Registrar.

WATER REGISTRAR'S OFFICE.
FALL RIVER, Dec. 31, 1874.

To the Watuppa Water Board:

GENTLEMEN,—In compliance with the provisions of the Ordinance for the care and management of the Fall River Water Works, the undersigned respectfully submits the following Report of receipts, etc., for the year ending Dec. 31, 1874:

RECEIPTS.

Water-rates paid City Treasurer,	$9,336 95

STATEMENT

Showing the number of families, stores, manufactories, etc., supplied with Watuppa water to Dec. 31st, 1874:

1 Pumping Station
8 Engine Houses
1258 Tenements and offices
12 Schools
3 Churches
1 City Hall
4 Station Houses
1 Club Stable
15 Private Stables
1 Carriage Shop
4 Breweries
6 Drug Stores
2 Dentist's Offices
2 Photograph Galleries
1 Pork-packing Establish'nt
5 Meat Markets
2 Fish Stalls
5 Bakeries
39 Stores
8 Steam Boilers
3 Machine Shops
1 Harness Shop
1 Post Office
1 Public Hall
1 Masonic Hall
5 Hotels
7 Eating Houses
1 Billiard Hall
8 Livery Stables
1 Card Factory
1 Planing Mill
1 Book-bindery
6 Barber Shops
1 Blacksmith Shop
2 Railroad Depots
1 Gasometer
2 Green Houses
6 Banks
2 Steamboats
4 Cotton Mills,(Toilet Rooms)
1 Engineer's House at Pumping Station
1 City Stable

METERS SUPPLIED.

21 $\frac{5}{8}$ inch
19 $\frac{3}{4}$ inch
9 1 inch
4 $1\frac{1}{2}$ inch

LIST OF SERVICE PIPES,

SHOWING NUMBER OF TAPS OF EACH SIZE.

PURPOSES FOR WHICH WATER IS SUPPLIED.	2 inch.	1 1-2 inch.	1 inch.	3-4 inch.	5-8 inch.	1-2 inch.	3-8 inch.	Total.
City Hall,	1		1					2
Engine Houses,			3	1	2			6
Hook and Ladder Co.,					1			1
Barn for Chief Engineer,						1		1
City Stable				1				1
Station House,				1				1
School Houses,			1	4	2	5		12
Pumping Station,			2	1				3
Drinking Fountains,						1	4	5
Drinking Troughs,						2		2
Water Posts,			16					16
TOTAL FOR CITY,	1		23	8	5	9	4	50
Dwelling Houses,			17	70	222	151	26	486
Churches,				1	2			3
Hotels,				1	4			5
Restaurants				1	1			2
Offices		1	1	2	3	3		10
Markets,					4	5		9
Groceries,					6	3		9
Bakeries,				1	3	1		5
Drug Stores,				1	2	2		5
Other Stores and Shops,			1	6	13	11		31
Banks,				2	3			5
Green Houses,				1	1			2
Machine Shops and Boilers,				2	2	5		9
Blacksmith Shops,					1	1		2
Steamboats,				1				1
Coal Yards,				1	1	1		3
Mills,			1	4	1	3		9
Railroad Depots,				2				2
Breweries				2	1	1		4
Stables				2	12	6		20
TOTAL PRIVATE TAPS,		1	20	100	282	193	26	622
TOTAL, PUBLIC AND PRIVATE,	1	1	43	108	287	202	30	672

Last April, a contract for laying the service pipes during the season of 1874 was made with Charles F. Clark and George W. Savage, of New London, Ct., who associated themselves with Charles E. Williams and N. A. Roberts, under the name of the Fall River Plumbing Co. A short time ago Messrs. Savage & Roberts left the firm, and the contract was completed by Messrs. Clark & Williams. The work has, with few exceptions, been well done, and at prices lower than were offered by any other parties. 607 service pipes have been put in under this contract, and 65 by days' work.

The total amount of trenching for the service pipes was 15,589 feet, of which 1376 feet were rock. The total length of pipes laid by the city was 14,840 feet, 14,727 feet of this being lead, 64 feet block tin, and 49 feet tin lined lead.

The sudden and long continued cold weather, this winter, has caused a number of the service pipes to freeze. The trouble has, however, occurred in nearly every case on the premises of the water takers, either through their carelessness or forgetfulness, or on account of some defective work on the part of the plumbers.

Care should be taken in shutting off the water at night. It is necessary to open the faucets at the same time that the stop and waste is closed in the cellar, so that by the introduction of air through the faucets all the water will be driven out at the waste stop below. There have been, so far, more applications for water than was anticipated. The city

labors under a disadvantage in having a smaller number of sewers than most cities of the same size, because, where streets are sewered, the takers are more general. The introduction of water necessitates sewers from the fact that a surplus of water is used which cannot be disposed of in any other way. It is probable that this objection will, to a great extent, be removed by the construction of a large number of sewers during the coming season.

Schedule of receipts for water, by months, from commencement to December 31st, 1874.

MONTHS.--1874.	Amount.	REMARKS.
June,	385 64	For two months.
July,	4,854 23	" one year.
August,	483 10	" eleven months.
September,	487 99	" ten "
October,	1,556 97	" nine "
November,	970 10	" eight "
December,	598 92	" seven "
	9,336 95	Amount paid City Treasurer.

You will observe by the above schedule that a large part of the water rent paid in is for fractional parts of the year, and during the next year the amount received from the present water takers will probably be $10,500.

Respectfully submitted,

C. H. CHURCHILL,

Water Registrar.

Report of the Engineer.

OFFICE OF THE
ENGINEER AND SUPERINTENDENT,
January 1st, 1875.

To the Trustees of the Fall River Water Works:

GENTLEMEN,—In accordance with the requirements of the Ordinance, passed March 30th, 1874, I herewith respectfully submit to you the first formal report of the progress and condition of the Fall River Water Works.

I shall, in the first place, give a brief history of the progress of the work up to the present time, explaining the general plan according to which the various operations have been conducted, and shall close by exhibiting concisely, in tabular form, the details of the several departments.

In the spring of 1871, a Board of Water Commissioners was appointed by the City Council, and, after visiting some of the principal Water Works throughout the country, and consulting some of the most eminent hydraulic engineers, the following general plan was adopted:

Watuppa Lake, situated about two miles east of the city, and covering an area of 5 1-2 square miles, was to serve as an immense storing reser-

voir, with a storage capacity of 10,000,000,000 gallons. This lake is situated at an elevation of 128 feet above mean high water in Mount Hope Bay, and, with a daily discharge of about 35,000,000 gallons, furnishes the water power which first made Fall River an important manufacturing centre.

The nearest and most convenient point for obtaining a supply of pure water, which will always be free from contamination by the drainage of this rapidly increasing city, was found to be on the western shore of the lake, about a mile north of the "Narrows," in a direct line with the continuation of Bedford Street, and at a distance of 9472 feet from Main Street. As some parts of the city are situated 130 feet higher than the lake, it became necessary to pump the water to a considerable elevation, and a pumping station was established at the head of Bedford Street.

If all the water were pumped high enough to furnish a sufficient head on the highest points, the extreme pressure in the lower portions of the city would require excessive strength in the main pipes and in all the connections throughout the houses, and would make the operation of the hydrants and stop gates both difficult and dangerous. On this account it was decided to divide the city into two parts, each of which would be supplied by an entirely distinct system of pipes, called the "High Service" and the "Low Service." This necessitated, it is true, the laying of two force mains from the pumping station to the city, but the saving in the cost of the pipes throughout the "Low Ser-

vice" more than counterbalanced this expense, and, moreover, in case of any accident to either of the force mains, the whole city could be temporarily supplied through the other, thus making the two services more advantageous, both in economy and safety.

Less than one-quarter of the area of the city was devoted to the "High Service," as the "Low Service" was made to include all those portions that could be satisfactorily supplied from a reservoir, which it was intended to construct, at some future time, on the hill between the pumping station and the city, where the elevation of the highest point is 256 feet above tide water.

ROAD AND PIPE TRENCH.

The first work done was the construction of a road and pipe trench from Quarry Street to the lake—about a mile in length. The road for a distance of 3400 feet was made by the city, under the direction of the Superintendent of Streets, and the remainder was done by the Water Board. Nearly one-half of the latter portion was through solid rock, in some places 18 feet in height, and at one point a ravine was crossed for a distance of over 300 feet, the bottom of which was seventeen feet below the road bed. The rock was taken out for the pipe trench to a depth of seven feet below the grade of the road, and with a width of ten feet.

The contract for the construction of this road and pipe trench, for a distance of 1700 feet on the

lot bought by the city, November 29th, 1870, and known as the "Reservoir Lot," was awarded to John Mangan, of Salem, who began work in October, 1871, and completed his contract in August, 1873, having during that time—besides the work included in the original contract—done a large amount of extra work in filling the coffer dam, filling in and grading around the engine house, excavating for the stand pipe, weir, etc.

The following is a summary of the amount and cost of all work done on the "Reservoir Lot" by John Mangan:

WORK INCLUDED IN ORIGINAL CONTRACT.

9,867	cubic yards	earth excavation from road and pipe trench.
10,932	" "	rock " " " " " "
85.54	" "	culvert masonry.

EXTRA WORK.

14,273	cubic yards	earth excavation for filling coffer dam, grading around engine house, etc.
307	cubic yards	rock excavation for same,
175	" "	earth " " stand pipe and weir,
174	" "	rock " " " " " "
4,373	" "	earth for back-filling pipe trench.

COST.

28,688	cu. yds.	earth excavation, at 28c, 55c, 60c,	$13,033 36
11,413	"	rock " at $2.25, $3.75,	30,836 27
85.54	"	culvert masonry, at $2.00,	171,08
			$44,040 71

STATEMENT OF COST IN ANOTHER FORM.

Construction of Road,	$20,393 40
" " Pipe Trench,	16,196 65
Excavation for stand pipe and weir,	748 75
Filling coffer dam, grading, etc,	6,701 91
	$44,040 71

PUMPING STATION.

On the first of June, 1872, a contract was made with George W. Lobdell, of Mattapoisett, for the construction of foundations for the engine house, boiler house, coal house, boilers and engine, and the contract was concluded in December of the same year.

On account of the rocky and precipitous shores at the point selected for the pumping station, it was necessary—in order to avoid an excessively steep grade and deep rock cuttings for the road and pipe trench—to locate the engine house in the lake about sixty feet from the old shore line, and consequently a coffer dam was required, inside of which the foundations could be constructed. In anticipation of this, the frame work of the dam had been built on the ice during the previous winter, and then lowered to its proper position. This frame work consisted of two parallel rows of sheet piling, maintained at a distance of 10 feet by 68 iron rods 12 1-2 feet long, 2 1-2 inches wide, and 1-2 inch thick. Each row of sheet piling was formed of 3 inch planks, sustained on the outside by two stringers 8 inches by 10 inches, and on the inside by two lines of one inch boards. The rods passed through the stringers and were keyed on the outside. By this arrangement the planks could be driven down into the mud until they brought up on hard bottom, and when rocks prevented the planks from being driven as far as necessary, sand bags were used to fill up the holes. The total length of the coffer dam was 294 feet, forming

three sides of a rectangle, which was completed on the fourth side by the shore.

In the spring the space between the two rows of piling was filled with earth, and the water was then pumped out from the enclosure, where the engine house was to be built. In some places the excavation for the foundations was carried down to solid rock, but generally the springy nature of the soil—similar to quicksand—made it necessary to put in first a layer of concrete 18 inches thick, and on this were built the foundation walls, 2 feet 10 inches wide on top, with a "batter" of an inch and a half per foot on each side.

The following is a summary of the work done under the contract with Mr. Lobdell:—

1,290	cu. yds. earth excavation,	at $1 00,	$1,290 00
15	" " " "	" 2 00,	30 00
11	" " " "	" 3 00,	33 00
1	" " " "	" 4 00,	4 00
57.45	" " rock "	" 2 00,	114 90
1.2	" " " "	" 4 00,	4 80
.8	" " " "	" 6 00,	4 80
1,286.74	" " rubble masonry,	" 10 00,	12,867 40
198.50	" " " " laid dry	" 8 00,	1,588 00
44.48	" " hammer dressed masonry	" 15 00,	667 20
187	" " concrete masonry,	" 10 00,	1,870 00
	Total, by contract,		$18,474 10
	Extra work on coffer dam, foundations for conduit, etc.,		2,254 93
	Total amount paid to G. W. Lobdell,		$20,729 03

GATE HOUSE AND CONDUIT.

In the fall of 1872, a conduit was built from the engine house to the gate house, the outer or eastern side of which is 105 feet from the engine house. The conduit is 87 feet long, 6 feet wide, and 4 feet high in the centre, covered by an arch formed of three layers of brick, the inside radius being 3 feet. The gate chamber is 10 feet long and 8 feet wide, the bottom, which is on a level with the bottom of the conduit, and one foot lower than the bottom of the pump well, being 10 feet below high water mark in the lake.

The gate chamber contains, besides the gates, three screens, to prevent fish and substances which may be in suspension in the water, from passing into the pump well and then into the pipes.

The gates are formed of 3 inch plank fitted loosely into cast iron guides or frames, and can be opened in such a manner that either the water from near the surface, or that from near the bottom, will pass into the pump well.

Inside of the engine house the main conduit is divided into four branches, each of which is intended to conduct the water to the pump well of one of the four engines for which the building is designed. At present, only one of these branch conduits is completed, the other three being closed by gates formed of three inch planks fitted into cast iron frames.

ENGINE HOUSE.

The engine house is built of "rough ashlar"

granite masonry; the underpinning, 2 feet 10 inches thick, laid in regular courses; the walls, 2 feet thick, in irregular courses, and the trimmings formed of cut stone—some with hammer dressed face, and some with "quarry face," according to the drawings and directions of Mr. H. M. Wilson, architect.

The stone work is laid in full beds of lime and cement mortar, with not less than one part of the best quality of Rosendale cement to two parts of lime, mixed with a sufficient quantity of clean, sharp sand.

The engine room is 80 by 56 feet, the boiler room, 53 1-2 by 23 feet, and the coal house, 86 by 21 feet.

PUMPING ENGINES.

The engine room was made large enough for four engines—two for the "High Service" and two for the "Low Service," which it was thought the increasing wants of the city would ultimately require.

At present there is but one engine which was built for the "Low Service" by the Boston Machine Co. It is a double, horizontal, condensing engine, similar to the one now in operation at Boston Highlands, built by the same company, and consists of two pumps, 16 inches in diameter, and two steam cylinders, 28 inches in diameter, both cylinders and pumps having a stroke of 42 inches, and working from one crank shaft with one fly wheel, 15 feet in diameter and weighing 15 tons.

The engine is well built, is simple and substantial in its design, and possesses one important advantage in the fact that the two parts are symmetrical, and, although designed to work together, can be run separately, and one-half can be stopped if it is necessary to make any repairs or to adjust the valves.

The engine began to pump into the mains on the 5th of January, 1874, and in Table VI will be found a statement in tabular form showing the work performed during the past year. It will be observed that the average quantity pumped per day from July 1st, 1874, to January 1st, 1875, is 752,684 gallons, but the average quantity consumed by the city has not exceeded 350,000 gallons, per day, for it is found to be more economical, while the amount required by the city is small, to take the water for condensing directly from the force main, as otherwise about this amount would run back to the lake from the overflow of the stand pipe; while the "donkey pump" must be used to pump the water needed for condensing whenever the full capacity of the engine is required to supply the city, as was the case during the fire at the American Print Works, Dec. 8th, 1874, when the engine made 20 revolutions per minute between 9 and 10 P. M., and pumped at the rate of about 4,000,000 gallons in 24 hours, the guaranteed capacity being 3,000,000 gallons in 24 hours with a speed of 16 revolutions per minute.

The water cylinder of the "donkey pump" is 12 inches in diameter with a stroke of 12 inches,

and to supply the condenser (Ramson's patent) a speed of 33 to 40 double strokes per minute is required, the average amount of water pumped being about 25,000 gallons per hour. From 6 A. M. till about 8 P. M.,—during which time the pumping engine runs without stopping—the condenser is supplied from the force main, and takes about 350,000 gallons. During the night, while the consumption in the city is small, the engine runs intermittently—just often enough to keep the water from falling below the bottom of the stand pipe—and during this time the condenser is fed by the "donkey pump."

During the day time, as has been said, the engine runs all the time and the stand pipe is kept full, a certain quantity of water generally running over by the waste pipe; this quantity varies from 50,000 to 100,000 gallons per day, so that at least 400,000 gallons per day find their way back to the lake, either through the condenser, or through the waste pipe from the stand pipe. Deducting this from the total quantity pumped, it will be seen that the average daily quantity consumed by the city probably falls short of 350,000 gallons.

In calculating the duty, the total amount of coal put into the furnaces was taken, without deducting anything for ashes and clinkers, or for the coal consumed in raising steam and banking fires. Moreover, it must be remembered that the quantity of water pumped during the night is very small, while the fires are kept up all the time, so that, if the fire alarm is struck, the engine may be ready

immediately to supply all the water that is needed. In fact, the quantity of water pumped during the night varies from 30,000 to 75,000 gallons, (or from one-twenty-fifth to one-tenth of the total daily average,) while the coal consumed during the same time varies from 900 to 1200 lbs., (or from about one-fourth to one-third of the daily average).

Taking these things into consideration, it will be seen that the average duty of 27,833,973 for the last six months, and of more than 31,000,000 for the last three months, is very creditable to the engine and compares very favorably with the recorded duty of other engines that pump directly into the mains without a reservoir.

The increasing demand in the city for more water will probably make the duty larger during the next six months.

The surveyed height from the gauge in the engine room to the centre of the 10 inch waste outlet of the stand pipe is 133.7 feet, and the height from the gauge to the water in the pump well has varied during the last six months from 14.3 to 17 feet. The gauge is attached to the force main at a distance of 55 feet from the pumps, and by the terms of the contract an allowance of 2 lbs. is to be made for friction in the pipes, check valves and foot valves between the gauge and pump well. Actual experiment shows that the total friction from the pump well to the gauge (including the pumps themselves) is 5 1-2 lbs. at a speed of 17 revolutions per minute, and that the friction in the force main beyond the gauge is 2 1-2 lbs.

DISTRIBUTION.

The distributing mains are all of cast iron, the thickness varying with the pressure to which the pipes are subjected. The area included in the "Low Service" is divided into four classes: class A including the higher portions, where the head of water does not exceed 80 feet; in class B the head varies from 80 to 140 feet; in class C, from 140 to 200 feet; and in class D, from 200 to 260 feet. The thickness of each size varies in the different classes, and although this involves some extra expense in plans and patterns, yet the reduction in the weight of metal in the lighter classes makes a great saving in the cost to the city.

In calculating the thickness of the pipes of the various sizes and classes, a careful examination was made of the formulae recommended by James P. Kirkwood, Chief Engineer of the Brooklyn Water Works; John F. Ward, Chief Engineer of the Jersey City Water Works; J. Herbert Shedd, Chief Engineer of the Providence Water Works; M. Dupius, Chief Engineer of the Paris Water Works, and others, and the values adopted for Fall River, although somewhat less than those recommended by Mr. Kirkwood, were generally greater than those adopted by the other authorities that were consulted, especially in class D, where the extreme pressure is considerably greater than in most other cities, but from the fact that the pipes have been subjected to a pressure of 15 feet more head than was at first anticipated, making the extreme head

275 instead of 260 feet, it is safe to conclude that the thickness adopted for the various sizes was sufficient.

The following table shows the thickness, standard weight, etc., adopted for the various classes:

Class.	Nominal Diameter Inches.	Exterior DIAMETER Inches.	Thickness of Metal, Inches.	Standard Weight for 12 ft. lengths	Thickness of Bell, Inches.	Interior Diameter of Bell, Inches.	Depth of Bell, Inches.
A.	24	26	3-4	2316	7-8		
B.	24	26	1	3081	1 3-16	26 3-4	5
b.	24	26	7-8	2689	1		
A.	20	22 5-8	5-8	1684	3-4		
B.	20	22 5-8	7-8	2327	1		
C.	20	22 5-8	1 1-8	2971	1 5-16	23 3-8	5
D.	20	22 5-8	1 5-16	3478	1 9-16		
A.	16	18 1-4	9-16	1216	11-16		
B.	16	18 1-4	3-4	1613	7-8		
C.	16	18 1-4	15-16	1989	1 1-16	19	4 3-4
D.	16	18 1-4	1 1-8	2370	1 5-16		
A.	12	13 7-8	1-2	822	5-8		
B.	12	13 7-8	5-8	1018	3-4		
C.	12	13 7-8	25-32	1255	15-16	14 5-8	4 1-2
D.	12	13 7-8	15-16	1475	1 1-16		
A	10	11 5-8	15-32	642	9-16		
B.	10	11 5-8	19-32	802	23-32		
C.	10	11 5-8	11-16	889	13-16	12 3-8	4 1-2
D.	10	11 5-8	13-16	1041	15-16		
A.	8	9 1-2	7-16	489	17-32		
B.	8	9 1-2	17-32	581	5-8		
C.	8	9 1-2	5-8	684	3-4	10 1-4	4 1-4
D.	8	9 1-2	3-4	812	7-8		
A.	6	7 1-4	13-32	341	1-2		
B.	6	7 1-4	15-32	392	9-16		
C.	6	7 1-4	17-32	439	5-8	8	4
D.	6	7 1-4	5-8	514	3-4		
A.	4	5 1 16	3-8	215	7-16		
B.	4	5 1-16	13-32	233	1-2		
C.	4	5 1-16	15-32	265	9-16	5 13-16	3 1-2
D.	4	5 1-16	17-32	298	5-8		

The exterior diameter of the pipes is the same for every class of the same size, the variation in thickness making the interior diameter vary slightly in the different classes, but never making it less than the "nominal diameter." The interior diameter of all the bells is the same for each size, so there is no trouble in laying pipes of one thickness or class in connection with those of another class.

The pipes are all cast vertically with the bell end down, so that the impurities in the iron will be more likely to collect at the spigot end, a few inches of which could be cut off, if defective, while the bell end will be compact and homogeneous in texture.

After a thorough and careful hammer inspection, the pipes are coated with coal-pitch varnish while hot, and then, when cold, subjected to a hydrostatic pressure of 300 lbs. per square inch, and while under this pressure the hammer test is repeated.

The iron used is required to be strong, tough and close grained, re-melted from pigs of "grey iron," and must stand a tensile strain of at least 16,000 lbs. per square inch.

In Table I, annexed to this report, will be found the size and length of pipes laid on each street previous to Jan. 1st, 1875.

As the supply for the whole city comes through the 24 inch main on Bedford street, it was thought best not to run any risk of weakening it by inserting taps for service pipes, or of having to shut off the water in case a tap was not successfully put in,

and on this account an 8 inch pipe, or "rider," was laid by the side of the 24 inch main and connected with it at intervals of about a thousand feet.

A 20 inch pipe is laid on Main street the whole length of the city, from Stafford street to the Border City Mills. During the coming season this pipe will be extended south nearly as far as Cook Pond, and then a smaller pipe extended to the Slade School House beyond Globe Village.

In order to keep up the head in the extreme north and south parts of the city, it will be advisable to lay two secondary mains 16 inches in diameter or more, one down Locust street and the other across the stream near the Wampanoag Mills. It will not be necessary to lay the whole of these two lines of pipe at present, but in all the work that is done now this general plan should be kept in view, so that no changes will be required in the future. It was with this object that a 16 inch pipe was laid in Locust street from Linden to Rock, and in Rock street from Locust to Prospect, although the pipes that lead to this 16 inch pipe at present are only six and eight inches in diameter.

In table II will be seen the amount of pipe of each size laid each month since May, 1872. It will be noticed that 3 miles of pipe were laid during 1872, nearly 7 1-2 miles in 1873, and nearly 13 1-2 miles in 1874, making a total of 23.81 miles.

Table III gives the amount of earth and rock trenching that has been done for each size of pipe. The fact that nearly one-quarter of the total amount

has been through rock will perhaps be nothing new to our citizens, but will explain to others the unusual difficulties that have been encountered and overcome in introducing a supply of water throughout the city.

Twenty-five connections have been made with the mains, for fire purposes exclusively, at the request of corporations that have paid the entire expense.

STAND PIPE.

The stand pipe for the "Low Service" is made of boiler iron, with a diameter of 3 feet 6 inches, and a height of 31 feet 4 inches, and its top is 280 feet above mean high tide. It rests upon an ordinary 24 x 24 three way branch, which is placed upon a solid block of granite, and is steadied by four iron bolts, 9 feet long and 2 inches in diameter. Its cost was $791.75.

The "High Service" engine will be ready for operation next July, and the "High Service" stand pipe should be ready at the same time. It will probably be similar in construction to the one already erected, and 50 feet higher.

MERCURY GAUGE.

A mercury gauge, similar to the one at the engine house, has been put up in this office, and connected directly with the Second street main.

Attached to the gauge is a model of the stand pipe, and the height of the mercury opposite this model shows the height of the water in the stand pipe on the hill.

FIRE HYDRANTS.

After a careful investigation of the various kinds of hydrants in use throughout the country, it was decided to adopt the kind known as the Flush Hydrant, with a portable "chuck" or hydrant head, containing four delivery nozzles 2 1-2 inches in diameter, with a separate valve for each, so that four lines of hose can be connected with each hydrant, and any one shut off without interfering with the others.

The hydrants are located on the sidewalk, just inside the curbstone, and are connected with the mains by 6 inch pipes, instead of 4 inch pipes, as has been customary in most cities heretofore. When not in use, they form no obstruction, being entirely below the sidewalk, surrounded by cast iron boxes large enough for convenient entrance.

Up to the present time 227 hydrants have been set, all of them manufactured by the Boston Machine Co., and, with the exception of the rubber in the valves, which in some cases has been found too soft for the pressure of the water and has been replaced by leather, the hydrants have given very good satisfaction. They are placed from 250 to 500 feet apart, and in the more compact parts of the city are so arranged that a dozen lines of hose

not more than 500 feet in length can be brought to any point.

In table IV will be found a list of all the hydrants, with their locations, that have been placed in position up to the present time.

On the afternoon of April 11th, 1874, a trial was had of the hydrants on Main street. Although a violent south wind was blowing at the time, yet those who were present expressed their satisfaction with the success and efficiency of the Water Works. Water was thrown simultaneously from five hydrants through sixteen lines of hose, the size of the nozzles being as follows:

At Pocasset street, two 1 inch streams, one $1\frac{1}{4}$ inch stream.
" Bedford " " 1 " " " $1\frac{1}{4}$ and one $\frac{7}{8}$ inch streams.
" Bank street, two 1 inch streams, one $1\frac{1}{8}$ inch stream.
" Elm " three $\frac{3}{4}$ " "
" Pine " two 1 " " " $1\frac{1}{4}$ " "

During one hour, from 4 to 5 P. M., 123,000 gallons were discharged, which was less than two-thirds of the capacity of the engine. All of the streams were thrown to a height of between 70 and 80 feet, and at 5 o'clock all were shut off except one 1 1-4 inch stream at Pocasset street, which was thrown as high as the clock on City Hall tower, an elevation of 90 feet above the sidewalk. The static head on Main street is about 150 feet, and when the sixteen streams were playing, the friction in the pipes reduced the head to about 130 feet.

During the fire at the Granite Mill, on the 19th September, only seven streams were thrown from the hydrants, the available head being about 130 feet, and less than one-half the capacity of the engine was called into requisition, as the steamers and force pumps from the neighbring mills took water directly from the pond.

At the fire in the American Print Works, Dec. 8th, it is estimated that fifty streams were thrown upon the fire, half of which were supplied by the Water Works. From 9 to 10 P. M. the engine pumped 2700 gallons, or 85 barrels, of water every minute, the "head" at the Print Works during that time being about 180 feet.

At several of the fires that have occurred during the last year the hydrants have not been fully opened, and the water has not been thrown with as much force as was anticipated. It is important that those who have charge of the hydrants during the fires should understand perfectly the manner of operating them. It requires twenty-four full turns to open the main valve of the hydrant, and sixteen turns to open the small valves in the "chuck."

STOP-GATES.

It is important to arrange the stop-gates along the lines of the mains so that repairs and extensions can be easily and economically made, and the water cut off from any section by shutting a small number of gates.

Up to the present time 302 gates have been set, averaging nearly thirteen for every mile of pipe. They were made by the Boston Machine Company, and, like all the other work from that company, are very creditable pieces of workmanship.

Table V gives a complete list of the size and location of all the gates.

SERVICE PIPES.

Six hundred and seventy-two service pipes have been attached to the mains, and of this number six hundred and sixty-eight are lead, two block tin, and two tin-lined lead.

Lead is always put in as far as the street line, unless water takers desire to have block tin or tin-lined lead, and as there have been, from time to time, doubts expressed about the safety of using water through lead pipes, it will not be out of place to state here the reasons which have led to the adoption of this kind of pipe.

The prejudice against lead has arisen from the fact that certain kinds of water, when brought in contact with lead, form a combination which is a dangerous poison—all the more dangerous because its insidious effects are cumulative, but this action depends on the quality of the water, and in many cases there is no action at all.

The facts of the case are essentially as follows:—Pure distilled water attacks and dissolves lead with great rapidity; rain water not quite so

rapidly; well water *sometimes* attacks it—the rapidity and amount of action depending on the earthy salts held in suspension in the water; and river water, if it has flowed any considerable distance, and lake or pond water which has been aerated or oxydized by contact with the atmosphere, almost never makes any impression upon lead.

When there is any action, it generally ceases after two or three weeks, on account of the formation of a thin coating on the inside of the pipe, impervious to water.

At the time Professor Dumas (one of the most noted of French chemists) investigated the subject, the total number of lead service pipes in Paris was 39,495. The result of most careful experiments made by him upon water from different sources, after passing through the lead branch into the house was, that in inhabited houses, that is to say, where the water never remains stationary in the lead pipe for more than ten to twelve hours, not a trace of lead could be discovered.

The Commission appointed by the British Parliament some years since, to investigate and report what kinds of pipes were the *healthiest* and best for conveying water, decided in favor of lead.

The Cochituate Water Board, after speaking of the experiments of Prof. Horsford, of Harvard University, says: "These experiments demonstrate that the action of the comparatively pure water of lakes and rivers upon bright bars of lead, which, on their immersion in it, is distinctly perceptible,

ceases after a period of a few days; and that this immediate action of the water upon the surface of the lead forms a coating, which, for all practical purposes, is impervious to water, and entirely insoluble in it."

A most satisfactory confirmation of the experiments of Prof. Horsford was furnished to us when the 24 inch main was laid in Bedford street in the summer of 1873. A piece of lead pipe 1 3-8 inches in diameter was then cut out, which had been laid by Mr. Hazard Bush about forty years ago, for the purpose of supplying the stables in Court Square with water from the pond, of the same quality as that which is now distributed through the city. This piece of pipe may be seen in the office of the Water Board; it is as perfect as when first put in, and the interior surface is beautifully coated with an insoluble formation which completely protected the pipe from further attack by the water.

The report of the Cochituate Board proceeds to say:—"The negative evidence that no well authenticated case of disease has occurred, in consequence of drinking the water furnished by the public water works of the cities of London, Philadelphia, New York, and many other places, where distributed through leaden pipes, authorizes the belief that the scattered cases of disease, which have been usually traced to the use of water from wells and springs, have arisen from some property peculiar to the water from these sources not common to water derived from lakes and rivers."

If necessary, more testimony could be given from experts and professional men in this and other countries, all tending to the same result, and proving that, by the formation of an insoluble incrustation, lining the pipes, the dangerous action of water on lead is prevented, and that, in the opinion of the highest authorities, lead pipes are the best that can be used for the conveyance of ordinary river and lake water.

AMOUNT OF WATER TAKEN FROM WATUPPA LAKE.

The area of Watuppa Lake has been variously estimated by different surveyors from 5 1-2 to 5.81 square miles. From a comparison of the best maps that have been made, we have been led to adopt 5.52 square miles, which is probably somewhat less than the true area at high water mark, but sufficiently correct for the purposes of the following estimate.

Assuming this to be the area, let us see what effect would be produced upon the quantity of water in the lake by a draught of 1,500,000 gallons per day, which is the daily quantity that the city has elected to take for a period of five years.

1,500,000 gallons per day will amount to 547,500,000 gallons, or 73,195,187 cubic feet per annum.

5.52 square miles = 153,888,768 square feet.

Consequently by a draught of 1,500,000 gallons per day, the lake will be lowered during an entire year by

$\frac{73,195,187}{153,888,768}$ feet, or less than 5 3-4 inches.

The "North Pond" alone, if separated from the "South Pond" would be drawn down about 13 inches during the same length of time.

If the engine should pump at its maximum speed night and day during a whole year, the water in the lake would be lowered *less than a foot and a half.*

HIGH SERVICE.

A contract has been lately made with Henry R. Worthington, of New York, for a duplex pumping engine, capable of raising 5,000,000 gallons in 24 hours to a height of 200 feet, under a boiler pressure not exceeding 45 lbs. per square inch, and at a plunger speed of not more than 110 feet per minute. This engine is guaranteed to perform a duty of 65,000,000; that is, to raise 65,000,000 lbs. of water one foot high for every 100 lbs. of coal burned.

It is similar in construction to the engines now in use at Cambridge, Salem, Charlestown, Philadelphia, Newark, Montreal and many other places, and possesses the following important advantages over Cornish and rotative engines:—

The movement of the water column through the force main is more uniform, the mass (and consequently the momentum) of the moving parts is less, the slight pause at the end of each stroke allows the valves to seat themselves more quietly, and, lastly, the foundations required are less expensive.

The "duplex" engine is designed to supply the "High Service" through a 16 inch main, which is already laid as far as Twelfth street, but the gates are so arranged that, in case of any accident to either engine or to either force main, the other engine can temporarily supply the whole city.

When these arrangements are completed, the city will be well protected against every probable casualty, but as it is very important—when the whole city, and especially the Fire Department, has become dependent upon the Water Works—to guard against every contingency, I would recommend the construction, at an early day, of a reservoir capable of containing about 25,000,000 gallons.

Respectfully submitted,

WILLIAM ROTCH,

Engineer and Superintendent.

TABLE I.

LIST OF PIPES LAID PREVIOUS TO JAN. 1, 1875.

STREETS.	LOCATION.	LENGTH IN FEET OF EACH SIZE.						
		24 in.	20 in.	16 in.	12 in.	10 in.	8 in.	6 in.
Annawan,	South Main to Water,					2,350		
Ballard,	North Court to Oregon,						60	
Bank,	North Main to Oak,							1,225
"	Linden to Ford,							113
Barnaby,	Prospect to French,							556
Bedford,	N. Main to Engine House	9.553	267	7,048			4,436	
"	At Engine House,					76	120	33
Borden,	South Main to Hartwell,							925
Brownell,	North Main to Davol,				1,307			
Canal,	Annawan to Spring,						518	
"	Spring to Ferry,							334
Central,	North Main to Davol,					1,421		
"	Davol to Water,						959	
Cherry,	North Main to Rock,							690
"	High to Linden,							1,040
Chestnut,	At Bedford,							38
Columbia,	South Main to Broadway,						2,339	
Cottage,	South Main to Second,						1,030	
Court Square.	North Main to Bedford,							471
Covel,	Bedford to Old Bedf'd Rd.						1,294	
Danforth,	Maple to Davol,							315
Davis,	At Bedford,						52	
Davol,	Central to Turner.						3,310	
"	Brownell to Ferry Lane,					1,815		
Durfee,	Pine to Turner,							2,785
East Main,	Lee to Stafford,		331					
Eighth.	Bedford to Pleasant,							550
Eight Rod Way	Pleasant to Rodman,			1,957				
Elm,	North Main to Davol,							1,329
Ferry,	Washington to Mulberry,							971
"	Mulberry to Linen Mill,						1,499	
Ferry Lane,	Davol to Morton, etc.,						1,075	
Ford,	Bedford to Bank,							363
Fourteenth,	From Bedford, South,							532
Fourth,	Pleasant to Branch,						2,396	
Franklin,	North Main to Rock,							600
"	Winter to Oak,							53
Freedom,	S. Main to Engine House,							354
George,	Morton to Oregon,						75	
"	Oregon to Davol,							810
Green,	Central to Pine,							689
Grove,	Pine to Cherry,						329	
Hartwell,	Fourth to Rodman,							1,330
High,	Pine to Cherry,							351
"	Locust to New Boston Rd.							493
Hood,	At North Main,							30
John,	Rodman to Morgan,							543
June,	Cherry to Prospect,							1,652
Langley,	At North Main,				30			
Linden,	Bank to Locust,							1,325
Locust,	North Main to Rock,						745	
"	Rock to Linden,			1,350				
Maple,	North Main to Danforth,							707
"	From New Boston Rd.,w.							252
Mill,	From Water, east,							52
Morgan,	South Main to Second,							556
Morton,	George to Ferry Lane,						600	
Mulberry,	Ferry to Columbia,							381
New Boston Rd.	From Maple, north-east,						177	
" " "	High to Maple.							285
North Court,	Brownell to Ballard,						458	
North Main,	Pocasset to B. C. Mills,		11,345					
Oak,	Bedford to Franklin,							585

TABLE I.—Continued.

STREETS.	LOCATION.	LENGTH IN FEET OF EACH SIZE.						
		24 in.	20 in.	16 in.	12 in.	10 in.	8 in.	6 in.
Old Bedf'd Rd.	Quequechan to Covel,						155	
Orange,	Bedford to Pine,							1,008
Oregon,	Ballard to George,						690	
Old Main street,	At junction with N. Main,							26
Pearl,	Annawan to Columbia,							933
Pine,	Green to Linden,						2,570	
Plane,	From Bedford, north,							336
Pleasant.	South Main to 12th,				2,260			
"	From Quequechan, west,				520			
Pocasset,	2d to 3d,							214
Pond,	At cor. Central,							20
Prospect,	North Main to Rock,						994	
Purchase,	Franklin to Cherry,							759
Quarry,	At Bedford,				82			
Quequechan,	Pleasant to Old Bedf'd Rd.							655
Read,	At cor. North Main,						43	
Ridge,	Cottage to South,							328
Robeson,	At cor. Bedford,			50				
Rock,	Bedford to Locust,						1,675	
"	Locust to Prospect,			1,315				
Rodman,	South Main to 8 Rod Way,			2,105				
Sagamore,	At cor. North Main,					44		
Second,	Bedford to Pocasset,							297
"	Pleasant to Rodman,							1,229
"	Rodman to Cottage,						1,195	
"	Cottage to Branch,					219		
"	Branch to Middle,							687
Seventh,	Across Bedford,						60	
Sheffield,	Westgate to Winslow,							287
South,	South Main to Ridge,							336
South Main,	Pocasset to Lee,		5,000					
" "	Stafford to Freedom,							321
Spring,	Second to Canal,							1,727
Stewart,	At cor. North Main,							28
Stafford,	East Main to South Main,					110		
Third,	Pocasset to Wade,							1,683
Tremont,	At cor. Bedford,							42
Troy,	Bedford to Pleasant,							539
Turner,	North Main to Davol,				418			
Twelfth,	Bedford to Pleasant,			580				
Union,	Annawan to Columbia,							1,000
Wade,	Second to Third,							249
Walnut,	North Main to Rock,							792
Washington,	Annawan to Columbia,						1,046	
Water,	Annawan to Central,						581	
Weetamoe,	At cor North Main,			5				
William,	From South Main, west,				49			
Winter,	Franklin to Walnut,							1,437
Weaver,	North Main to West,					1,399		
Westgate,	From Weaver, South.							510
Winslow,	From Weaver, South,							505
West,	From Weaver, South,						410	
Three contemplated streets near Narragansett Mill,	At cor. North Main,						28	
	At cor. North Main,							30
	At cor. North Main,							39
Hydrant connections.								2,010
"Blow-offs,"								455
Totals up to Jan, 1st, 1875,		9,553	16,943	14,410	4,666	7,434	30,919	41,806

TABLE II.

MONTHLY RECORD OF PIPES LAID.

DATE.	LENGTH IN FEET OF EACH SIZE.							Total for each month.	Total, up to date.	
	24 in.	20 in.	16 in.	12 in.	10 in.	8 in.	6 in.		Feet.	Miles
May, 1872						1,700		1,700	1,700	0.32
June, "						2,418	462	2,880	4,580	0.88
July, "						1,703	713	2,416	6,996	1.32
August, "						1,785	389	2,174	9,170	1.73
September, "		1,439				228		1,667	10.837	2.05
October, "		1,693				190	36	1,919	12.756	2.41
November, "		1,964						1,964	14,720	2.78
December, "		722				431		1,153	15,873	3.00
March, 1873,							632	632	16,505	3.12
April, "	356	687	478			580	2,362	4,463	20.968	3.97
May, "	1,564		1,072			619	1,029	4,284	25,252	4.78
June, "	2,872		1,801					4,673	29,925	5.66
July, "	2,072		2,045			275		4,392	34,317	6.49
August, "	1,042		2,362			880	15	4,299	38,616	7.31
September, "	1,026		429	71		2 329	1,695	5,550	44,166	8.36
October, "	146		2,338		59	897	1.017	4,457	48,623	9.19
November, "	432	406	679	776	981	1,362	503	5,139	53,762	10.18
December, "	43	145		480	136	231	374	1,409	55,171	10.45
January, 1874.						64	122	186	55,357	10.48
March, "					342	786	118	1,246	56,603	10.72
April, "					1,400	2,063	2,396	5,859	62,462	11.83
May, "		408	1,229		975	2,330	1,894	6,836	69,298	13.10
June, "		3,227	6	117			22	3,372	72.670	13.76
July, "		400		2,102		405	316	3,223	75,893	14.37
August, "			521	162	1,816		4,726	7,225	83.118	15.72
September, "			1,209	273		2,227	3,343	7,052	90,170	17.07
October, "		4.754			80	2,810	9.133	16,777	106,947	20.25
November, "		1,098	241	685	1,645	4,020	8,999	16,688	123,635	23.41
December, "						586	1.510	2,096	125,731	23.81
Totals up to Jan. 1st, 1875.	9,553	16,943	14,410	4,666	7,434	30.919	41,806	125,731		23.81

TABLE III.

SCHEDULE OF TRENCHING FOR WATER PIPES, PREVIOUS TO JAN. 1st, 1875.

CORRESPONDING SIZE OF PIPES.	LINEAL FEET OF EARTH TRENCHING			LINEAL FEET OF ROCK TRENCHING.			Total Earth and Rock.
	By Contract.	By Days Work	Total.	By Contract.	By Days Work	Total.	
24 inch,	1,196	235	1.431	1,325	11	1,336	2,767
20 "	5.518	9,745	15,263	1,131	594	1,725	16,988
16 "	2,487	3,035	5,522	1,799	1,036	2,835	8,357
12 "	468	2,973	3,441	389	953	1,342	4,783
10 "	168	5.222	5,390	830	1,356	2,186	7,576
8 "	10.018	13,823	23,841	3,499	1,785	5,284	29,125
6 "	6.819	26.582	33,401	2,443	7,624	10,067	43,468
8, 16, and 24 inch. 12th Street to Quarry Street, Trench 9 feet wide,	1,343		1,343	457		457	1,800
16 and 24 inch, Quarry Street to Res'r Lot, Trench 7 feet wide,	957		957	2,471		2.471	3,428
16 and 24 inch, On Reservoir Lot, Trench 10 feet wide in rock,	930		930	635		635	1,565
" 7 " " " earth,							
Total,	29,904	61,615	91,519	14,979	13,359	28,338	119,857

NOTE.—It will be seen by the above Schedule that 23 64-100 per cent. of the whole amount of trenching has been through rock.

TABLE IV.

LOCATION OF FIRE HYDRANTS, JANUARY 1, 1875.

ANNAWAN STREET.

S E cor. Pearl street.
N W cor. Union street.
N W cor. Pond street.
N E cor. Water street.

BANK STREET.

S side, 12 ft. W of house No. 45. opposite West gate post.
S side, in front of house No. 17, 4 ft. E of W. line.

BARNABY STREET.

S E cor. French street.
E side, 8 ft. N of house No, 5.

BEDFORD STREET.

Centre of Road, 107 ft. W of Engine House.
S side 40 ft. E of Covel street.
S E cor. Quarry street.
S side, 9 ft. E of W line of School House lot.
S side, 5½ ft. E of Davis street.
S E cor. 14th street.
S E cor. 13th street.
S E cor. 12th street.
S E cor. 11th street.
S E cor. 9th street.
S E cor. 7th street.
S E cor. Troy street.
S E cor. Market Square,

BROWNELL STREET.

S E cor. Thompson street.
S E cor. Boomer street.
S E cor. Lindsey street.
S E cor. Davol street.

CANAL STREET.

S E cor. Annawan street.
N E cor. Spring street.
N E cor. Ferry street.

CENTRAL STREET.

N W cor. Stone Lane.
S side, opp. E line of Green street.
S side, opp. W line of Van Buren street.
S side, opp. E line of Davol street.
S E cor. Pond street.

COLUMBIA STREET.

S E cor. Union street.
S side, in W line of house No. 22.
S side, opp. W line of Canal street.
S side, in W line of house No. 45.
S E cor. Eagle street.
S E cor. Broadway.

COTTAGE STREET.

S W cor. Whipple street.
S W cor. Ridge street.
S W cor. Forrest street.

COURT SQUARE.

N side, 3 ft. E of W Line of George E. Hoar's shop.

COVEL STREET.

N E cor. Wood street, 37 ft. S of David Healy's house.
E side, 6 ft. N of Wm. Bower's house.
N E cor. Old Bedford Road.

DAVOL STREET.

E side, 3 ft. S of lamp post at foot of hill.
E side, 21 ft. S of Flour Mill Barn.
E side, 14 ft. S of F. R. Coal Co.'s barn.
E side, S of R. R. crossing, 11 feet N. of telegraph pole.
E side, 105 ft. S of Clark Shove's office.
N E cor. Odd street.
S E cor. Turner street.
S E cor. Ballard street.
N E cor. Read street.
S E cor. George street.
E side, opp. N line of road to Slade's Ferry.

DURFEE STREET.

N E cor. Cherry street.
N E cor. Locust street.
N E cor. Walnut street.
N E cor. Cedar street.
E side, 24 ft. S of house No. 69, and 7 ft. S of angle.
E side, opp. N line of house No. 81.

EAST MAIN STREET.

S E cor. Stafford street.

EIGHTH STREET.

E side, 24 ft. N of house No. 24.

EIGHT ROD WAY.

W side, 85 ft. S of Durfee Mill.
E side, 3 ft. S of N line of Borden Mill Cotton house.

ELM STREET.

N side, opp. E line of house No. 13.
N side, 9 ft. E of W line of house No. 41.

FERRY STREET.

S side, 3 ft. E of W line of house No. 12.
S E cor. Fountain street.
S side, opp. shop No. 67, 15 ft. E of cor. of fence.
S side, 17 ft. E of Broadway and 67 ft. E of lamp post.
S side, 25 ft. E of Main gateway of Linen Mill.
S side, 7½ ft. W of Linen Mill.

FERRY LANE.

S E cor. Lindsey street.
S W cor. Leonard street.

FORD STREET.

S E cor. Bank street.

FOURTEENTH STREET.

E side, 66 ft. N of S tower of Merchants Mill.

FOURTH STREET.

S W cor. Borden street.
W side in N line of house of No. 33.
S W cor. Wade street.
W side, at angle 167 ft. S of Morgan street.
N W cor. Branch street.

FRANKLIN STREET.

S side, opp. E line of Purchase street.

FREEDOM STREET.

S side, opp. E line of Bowers street.

GEORGE STREET.

S E cor. Lindsey street.

GREEN STREET.

N E cor. Elm street.

GROVE STREET.

S W cor. Cherry street.

HARTWELL STREET.

S E cor. 5th street.
W side, 5 ft. S of house No. 22.
W side, 5 ft. S of telegraph pole at first angle N of Rodman street.

HIGH STREET.

N W cor. Cherry street.
N W cor. Walnut street.

JOHN STREET.

S E cor. Wade street.
E side, 9 ft. S. of Morgan street and 7 ft. N of angle,

JUNE STREET.

N E cor. Cherry street.
S E cor. Walnut street.
N E cor. Maple street.

LINDEN STREET.

E side, 26 ft. N of lamp post, opp. No. 9.
S E cor. Pine street.
S E cor. Cherry street.

LOCUST STREET.

S E cor. June street.
S E cor. Rock street.
S E cor. High street.
S E cor. Winter street.
S E cor. Grove street.
S E cor. Linden street.

MAPLE STREET.

S W cor. Durfee street.
S side, 11 ft, W of A. D. Easton's house.

MORGAN STREET.

S side, 8 ft. W of School House Gate.

MORTON STREET.

N E cor. George street.
S E cor. Ferry Lane.

MULBERRY STREET.

S E cor. Ferry street.

NEW BOSTON ROAD.

N E cor. Maple street.

NORTH COURT STREET.

S E cor. Ballard street.

NORTH MAIN STREET.

N E cor. Bank street.
E side, 6 ft. S of Elm street.
N E cor. Pine street.
N E cor. Cherry street.
N E cor. Locust street.
N E cor. Walnut street.
E side, opp. No. 135, 15 ft. S of angle.
S E cor. Prospect street.
E side, opp. N line of Odd street.
E side, foot of Lincoln Ave., 28 ft. N telegraph pole.
E side, opp. N line of house No. 183.
E side, 13 ft. N of Pierce street.
E side, opp. President's Ave., N of stone wall.

S E cor. Brownell street.
E side, 43 ft. S of Friend's Burial Ground.
E side, opp. S line of Read street, 13 ft. S of lamp post.
N E cor. Weetamoe street, 9 ft. N of end of white fence.
E side, 3 ft. N of S line of lot No. 219.
E side, opp. N line of Ferry Lane.
E side, opp. S end of fire escape of Narragansett Mill.
E side, 115 ft. N of Narragansett Mill.
N E cor. Langley street.
E side, 45 ft. S of Sagamore street.
E side, in N line of Montgomery street 30 ft. N of church.
E side, 3 ft. N of S line of Brightman Hall.
E side, 31 ft. N of lamp post, near bridge to B C Mills.
E side, 6 ft. N of S line of E Barrett's block.
E side, opp. N line of last B C Mills tenement house.

Oak Street.

N E cor. Bedford street.
S E cor. Bank street.

Orange Street.

E side, 3 ft. N of S line of house No 7.
E side, in front of store No 23.

Oregon Street.

N E cor. Read street.

Pearl Street.

E side, 4½ ft. S of house No 18.
E side, opp. division line between Lingane's block and Flint's Exchange.

Pine Street.

N W cor. Durfee street.
N E cor. Purchase street.
N E cor. High street.
N W cor. Grove street.

Plane Street.

E side, in N line of shop No 25.

Pleasant Street.

S E cor. 3d street.
S E cor. 4th street.
S E cor. Eddy's Ave.
S side, opp. E line of 9th street.
S side, opp. E line of 11th street.

Pocasset Street.

N side, 25 ft. E of Metacomet Engine House.
N side, 86 ft. W of Annawan Mill.

Prospect Street.

S W cor. School street.
S E cor. June street.

Quequechan Street.

N E cor. Turnpike.
E side, opp. S window of Davis School.

Rock Street.

N E cor. Bedford street.
N E cor. Bank street.
E side 17 ft. S of house No. 39.
S E cor. Cherry street.
N E cor. Walnut street.
N E cor. Maple street.
E side, 86 ft. N of R B Borden's lot.
S E cor. Prospect street.

Rodman Street.

S E cor. 2d street.
S E cor. 4th street.
S W cor. John street.
S E cor. Hartwell street.
S W cor. Eight Rod Way.

Second Street.

N W cor. North Market street.
S W cor. Borden street.
N W cor. Spring street.
N W cor. Morgan street.
W side, 5 ft. S of Marble street.
W side, 2 ft. S of Branch street.
W side, 4½ ft. S of No. 160.
N W cor Middle street. [Henry's Ave.]

South Street.

S W cor. Ridge street.

South Main Street.

S W cor. Pocasset street.
S W cor. Annawan street.
S W cor. Charity Lane.
S W cor. Spring street.
S W cor. Columbia street.
W side, opp. Morgan street.
S W cor. Washington street.
S W cor. Division street, 8½ feet W of Hunter street.
E side, 24 ft. S of N line of Durfee Ave.
S E cor. Park street, 30 ft. N of telegraph pole.
S E cor. Middle street.
N E cor. Hathaway Ave.
E side, 9 ft. S of N line of Rockland street.
E side, opp. N line of Freedom street.

SPRING STREET.

S E cor. Union street.
N W cor. Eagan's Court.

THIRD STREET.

S E cor. Borden street.
E side, 20 ft. S of house No. 38.
N E cor. Wade street.

TROY STREET.

E side, opp. N window of Belt Factory.

TURNER STREET.

S W cor. N Main street.

TURNPIKE.

S side, opp. Mary Crapo's house, 15 ft. E of telegraph pole.

TWELFTH STREET.

W side, in N line of house No. 6.

WADE STREET.

S E cor. Second street.

WASHINGTON STREET.

E side, 3 ft. N of S line of house No. 12.
E side, 3 ft. N of lamp post, head of Ferry street.

WATER STREET.

W side, N end of Print Works.

WINTER STREET.

N E cor. Franklin street.
S E cor. Pine street.
S E cor. Cherry street.
S E cor. Walnut street.

ON BORDER CITY MILLS PROPERTY.

SHEFFIELD STREET.

S E cor. Westgate street.

WEAVER STREET.

S E cor. James street.
S E cor Westgate street.
S side, 260 ft. W of houses on Winslow Steeet.

WEST STREET.

S E cor. Sheffield street.
S E cor. Weaver street.

WINSLOW STREET.

E side, in N line of block on N E cor. of Sheffield street.

TABLE V.

LIST OF STOP GATES, SET PREVIOUS TO JAN. 1, 1875.

STREETS.	LOCATION.	NUMBER OF EACH SIZE.						
		24in.	20in.	16in.	12in.	10in.	8in.	6in.
Annawan,	5 ft. W of S Main St.					1		
"	E line Washington St.					1		
"	17.5 ft. W of Canal St.					1		
"	6.5 ft. E of W line of Stone House							
"	W of Bridge					1		
	E line Water St. (looking north)					1		
Bank,	" N Main St.							1
"	W line Rock St.							1
"	E " "							1
"	W " Oak St.							1
Barnaby,	N " Prospect St.							1
Bedford,	About 40 ft. W of Engine House		3	1				2
"	" 900 " "	1						
"	At Stand Pipe	1		1				
"	50 ft. W of Stand Pipe	1		1				
"	11 ft. E of W line of Reservoir Lot							
	and 20 ft. from telegraph pole	1						
"	41 ft E of Covel St.						1	
"	16.5 ft W of E line of Covel St.						1	
"	E line of yard of house No. 230	1						
"	Blow-off 6 ft. E of Main Gate							1
"	" 8.5 " N "							1
"	W line of yard of house No. 230			1				
"	Blow-off 3 ft. E of Main Gate							1
"	" 45 " W "							1
"	E line Quarry St. (looking south)						1	
"	W " "						1	
"	17 ft. E of Varley St.	1						
"	2.5 " E " Davis St.						1	
"	6 " W " "						1	
"	11 " W " E line Granite Mill No 1						1	
"	24.5 " W " " " "			1				
"	29 " E " W line " "	1						
"	Blow-offs opp. " "							6
"	W line Twelfth St.						1	
"	E " Seventh "						1	
"	W " " "						1	
"	3.5 ft W of " "	1						
"	Blow-off 12 ft. E of Main St.							1
"	E line Market Sq.	1						
"	14.5 ft. W of E line Market Sq.						1	
Borden,	4 ft. E of S Main St.							1
"	E line Second St.							1
"	W " Fourth "							1
"	E " " "							1
Brownell,	W " N Main "				1			
"	2.5 ft. E of W line N Court				1			
"	E line Davol				1			
Canal,	Blow-off 12 ft. E of W line Canal							
	and 22 ft. N of Annawan							1
"	S line Annawan							1
"	S " Spring							1
Central,	W " Market Sq.					1		
"	4 ft. E of lamp post at Davol St.					1		
"	6 " W of E line of shed at Flour							
	Mill						1	
"	27 ft. W of Bridge						1	
Cherry,	E line N Main							1
"	W " Rock							1
"	W " Winter							1
"	E " "							1
"	W " Linden							1
Chestnut,	N " Bedford							1

TABLE V.—Continued.

STREETS.	LOCATION.	NUMBER OF EACH SIZE.						
		24in.	20in.	16in.	12in.	10in.	8 in.	6 in.
Columbia	W line S Main						1	
"	W " Canal						1	
Cottage	6.5 ft. W of E line S Main (looking S)						1	
"	8 ft. W of E line Ridge						1	
Court Sq.	E line N Main							1
"	N " Bedford							1
Covel	On Bedford between 8 and 24 in. pipes						1	
"	S line Bedford						1	
"	N line Old Bedford Road						1	
Danforth	Cor. Davol 12 ft. W of Railroad							1
Davis	N line Bedford						1	
"	On Bedford between 8 and 24 in. pipes						1	
Davol	N line Central						1	
"	17 ft. S of lamp-post opp. Morgan's Wharf						1	
"	3 ft. S of Turner						1	
"	N line Brownell					1		
"	2.5 ft. N of Read					1		
"	2 ft. S of Ferry Lane					1		
Durfee,	N line Pine							1
"	S " Locust							1
"	N " "							1
"	S " Maple							1
"	N " "							1
"	S " Odd							1
"	S " Turner							1
East Main	N " Stafford		1					
"	S " "		1					
Eighth	S " Bedford							1
"	N " Pleasant							1
Eight Rod Way	S " "			1				
" "	Blow-off 8 ft. N of angle in St.							1
" "	72 ft. N of Bridge			1				
" "	Blow-off 3 ft. S of Main Gate							1
" "	102 ft. S of Bridge			1				
" "	Blow-off 106 ft. S of Bridge							1
" "	" 98 " "							1
Elm	W line N Main							1
"	2 5 ft E of Green							1
"	10 " W "							1
"	7 ft. E of Davol and 35 ft. N of Central							1
Ferry	3.5 ft W of Washington							1
"	2.5 " Canal							1
"	W line Mulberry						1	
"	26 ft. E of Railroad						1	
"	31 " W "						1	
Ferry Lane	W line Leonard							1
"	2.5 ft. E of Lindsey							1
"	W line N Main							1
Ford	N " Bedford							1
Fourth	S " Pleasant						1	
"	N " Rodman						1	
"	S " "						1	
"	N " Morgan						1	
"	N " Branch						1	
Fourteenth	S " Bedford							1
Franklin	E " N Main (looking S)							1
"	2.5 ft. W of Rock							1
Freedom	S " " S Main							1
George	E line Davol							1
"	W " Oregon							1
Green	N " Central							1
"	S " Pine							1

TABLE V.—Continued.

STREETS.	LOCATION.	NUMBER OF EACH SIZE.					
		24in.	20in.	16in.	12in.	10in.	8in.	6in.
Grove	11 ft. N of Pine						1	
Hartwell	N line Rodman							1
"	E " Fourth (looking S)							1
High	N " Pine							1
"	12 ft. N of Locust							1
"	17 ft. N of S line Walnut							1
Hood	E line N Main							1
John	S " Rodman							1
June	S " Locust							1
"	N " "							1
"	S " Maple							1
"	S " Prospect							1
Langley	E " N Main				1			
Linden	S " Locust							1
"	S " Pine							1
Locust	E " N Main						1	
"	W " Rock (looking N)						1	
"	E " "			1				
"	E " Linden			1				
Maple	W " N Main							1
Market Sq.	4 ft S of Bedford		1					
Mill	E line Water							1
Morgan	E " S Main							1
"	W " Second							1
Morton	6 ft. S of Ferry Lane						1	
Mulberry	N line Columbia							1
North Court	N " Brownell						1	
North Main	6.5 ft. N of Bedford		1					
"	S line Pine		1					
"	3 ft. S of Maple		1					
"	5 ft. S of Telegraph pole S side Turner		1					
"	N line Turner (looking W)		1					
"	Blow-off 3 ft. N of House No. 183							1
"	11 ft. N of House No. 183		1					
"	Blow-off 145 ft. N of House No. 183							1
"	4.5 ft. S of Brownell		1					
"	N " "		1					
"	6 ft. N of S line Old Burying Ground		1					
"	Blow-off 45.5 ft. S of telegraph pole N of Narr. Mill							1
"	32 ft. N of telegraph pole N of Narr. Mill		1					
"	Blow-off S of Langley St.							1
"	N line Weaver St N line of old barn E of Main St.		1					
New Boston Road	11 ft. N of Maple						1	
Oak	N line Bedford							1
Old North Main	E " N Main							1
Orange	N " Bedford							1
Oregon	N " Read						1	
Pearl	S " Annawan							1
"	N " Columbia							1
Pine	6 ft. W of N Main						1	
"	11 ft. W of E line N Main and 5 ft. S of N line Pine						1	
"	W line Rock						1	
"	E " "						1	
"	W " Winter						1	
"	2.5 ft. E of Winter						1	
"	W line Linden						1	
Plane	N " Bedford							1
Pleasant	3.5 ft. W of E line Main (looking north)				1			
"	6.5 ft. W of Troy Block				1			
"	14 ft. E of W line Troy St.				1			

TABLE V.—Continued.

STREETS.	LOCATION.	NUMBER OF EACH SIZE.					
		24in.	20in.	16in.	12in.	10in.	8in.	6in.
Pleasant	E line Seventh				1			
"	W " Twelfth				1			
"	E " "				1			
"	W " Quequechan				1			
Pond	3.5 ft. S of Central St.							1
Prospect	E line N Main							1
"	W " Rock							1
Purchase	On Cherry W line Purchase							1
"	S line Pine							1
Quarry	N " Bedford				1			
"	S " "				1			
"	Between 8 and 24 in. pipes						1	
Quequechan	16 ft. N of Pleasant							1
Read	W line N Main						1	
Ridge	N " Cottage							1
Robeson	N " Bedford			1				
Rock	N " Bedford						1	
"	S " Pine						1	
"	S " Locust						1	
"	N " "			1				
Rodman	E " S Main			1				
"	E " Fourth			1				
"	W " Eight Rod Way			1				
Sagamore	W line N Main					1		
Second	S " Bedford							1
"	12.5 ft. S of Pleasant							1
"	N line Rodman (looking W)							1
"	S " " "						1	
"	N " Cottage						1	
"	S " "						1	
"	6 ft. N of S line Branch						1	
Seventh	S line Bedford						1	
"	N " "						1	
"	Between 8 and 24 inch pipes						1	
Sheffield	W line N Main							1
"	E " Winslow							1
South	E " S Main							1
South Main	N " Spring		1					
"	3 ft. N of S line of House No. 170		1					
"	18 ft. N of lamp-post opp. N end of Park Blow-off							1
"	14.5 ft N of lamp-post opp. N end of Park Blow-off		1					
"	9.5 ft. N of lamp-post opp. N end of Park Blow-off							1
"	S line Stafford							1
Spring	2.5 ft. E of S Main							1
"	W line S Main							1
"	12 ft. E of Washington (looking N)							1
"	E line Canal							1
"	W " Washington							1
Stafford	W " E Main					1		
Stewart	E " N Main							1
Summer	S " Annawan							1
Third	N " Pleasant							1
"	S " "							1
"	3.5 ft. N of Rodman							1
"	S line "							1
Tremont	N " Bedford							1
Troy	S " "							1
Turner	3.5 ft. W of N Main (looking N)				1			
Twelfth	14.5 ft. N of S line Bedford			1				
"	13.5 ft. S of Bedford			1				
Union	S line Annawan							1
"	N " Columbia							1

TABLE V.—Continued.

STREETS.	LOCATION.	NUMBER OF EACH SIZE.						
		24in.	20in.	16in.	12in.	10in.	8in.	6in.
Wade	E line Second							1
Walnut	E " N Main							1
"	W " Rock							1
Washington	5.5 ft. S of Annawan						1	
"	N line Columbia						1	
"	7 ft. S of Spring						1	
Water	3 ft. S of Crossing S side Central						1	
Weaver	W line N Main					1		
"	W " Winslow					1		
West	S " Sheffield						1	
Westgate	S " Weaver							1
William	13 ft. W of S Main				1			
Winslow	S line Weaver							1
Winter	N " Locust							1
"	S " "							1
"	S " Pine (looking E)							1
Three contemplated streets near Narragansett Mill	E " N Main						1	
	W " "							1
	W " "							1
FOR MILLS, ETC.								
Border City, No. 1	18 ft. E of W line of West St. opp. N hydrant in yard							1
" "	18.5 ft. E of W line of West St. opp. S end of Fire Escape							1
" "	18.5 ft. E of W line of West St. opp. S hydrant in yard							1
" No. 2	29.5 ft. S of S line of Mill opp. hydrant in yard							1
Durfee	32 ft. N of hydrant N end of Eight Rod Way							1
Iron Works	6 ft. W of Water St. and 8 ft. N of Print Works Yard							1
Linen	In Ferry St. 12 ft. W of Gateway, between Mills						1	
Mechanics	15.5 ft. E of W line Davol St. opp. hydrant in yard							1
"	15.5 ft. E of W line Dovol St. opp. hydrant in yard							1
Merchants	14 ft. E of W line Fourteenth St. opp. hydrant in yard							1
"	14 ft. E of W line Fourteenth St opp. S line N tower							1
"	14 ft. E of W line Fourteenth St. opp. hydrant in yard							1
"	14 ft. E of W line Fourteenth St. opp. hydrant in yard							1
Metacomet	16.5 E of W line Canal St. and 25.5 ft. N of Annawan St.							1
Narragansett	14 ft. W of E line N Main St. opp. hydrant in yard							1
"	14 ft. W of E line N Main St. opp. hydrant in yard							1
Pocasset	5 ft. N of S side Central St. opp. centre of large doors E of Cotton House							1
"	5 ft. N of S side Central St. between Mills							1
Propeller Wharf	In Central St. 10 ft. E of line of shed on wharf							1
Print Works	In sidewalk opp. fifth pier N of tower							1
Sagamore	7 ft. S of telegraph pole, at Langley St.							1

TABLE V.—Continued.

MILLS, ETC.	LOCATION.	NUMBER OF EACH SIZE.						
		24in.	20in.	16in.	12in.	10in.	8in.	6in.
Steamboat Wharf,	34 ft. S of main Railroad track in W line Water St.							1
Tecumseh	21.5 ft. N of S line of Mill, & 20.5 ft. W of E line Hartwell St.							1
"	7 ft. N of S line of Brow St. & 21 ft. W of E line of Hartwell St.							1
Troy	In sidewalk 48.5 ft. E of W line of Mill							1
"	16.7 ft. E of W line Davol St. nearly opp. lamp-post							1
"	16.5 ft. E of W line Davol St. 13 ft. S of office							1
Union	In sidewalk on Bedford St.							1
Weetamoe	14 ft. E of W line Troy St. opp. hydrant in yard							1
"	14 ft. E of W line Troy St. opp. hydrant in yard							1
		9	20	17	15	14	64	163

Total number of Gates, 302

TABLE VI.

STATEMENT OF WORK DONE DURING 1874, BY PUMPING ENGINE BUILT BY BOSTON MACHINE CO.

DATE. 1874.	Revolutions: Single Engine 69 gals. per rev.	Revolutions: Double Engine. 138 gals. per. rev.	Gallons Pumped: Per Month.	Gallons Pumped: Aver'ge per day.	Coal Consumed: Raising Steam and Bank'g	Coal Consumed: Pumping.	Coal Consumed: Total.	Coal Consumed: Ashes and clink'rs	Wood in feet.	Oil in Galls.	Total Head of Water. Feet.	Gauges: Steam. lbs.	Gauges: Vac'm. Inches.	Steam Cut-off. per cent. of stroke	DUTY in lbs. of water raised 1 ft. high by 100 lbs. coal.	REMARKS.
Jan. 1, 1874 TO July 1, 1874.	77,135	300,000	7,770,389	259 014	30,000	441,235	474,235				137.	45.	24.	12	11,270,360	Previous to July 1, no regular record was kept. These values are therefore only approximate.
July,		72,922	10,063,236	324,620	1,235	67,552	68,787	9,557	4	23.	136.15	48.57	24.35	12	16,934,532	Engine run until stand-pipe was full and then stopped until it was empty.
August,	2,964	118,102	16,502,592	532.342	550	93,716	94,266	14,046		22.5	149.20	45.47	24.32	11	21,992,216	After Aug. 6th the engine was run constantly during day from 6 A.M. till 8 P.M.
September,	36,191	178,792	27,170.475	905.683	3,978	120,773	124,751	19.318	14	21.	153.57	45.17	22.71	11	27,928,400	1,458,000 gallons used for condensing Sept. 27th to Sept. 30th.
October,		212,504	29,325.552	945,992		122,004	122,004	17,373	4	27.5	154.76	45.94	23.78	12	31,041,064	About 350,000 gallons per day used for condensing.
November,		188,705	26,041,290	868,043	600	108,819	109,419	11,471	2	21.5	155.65	45.35	25.07	11	30,931.903	About 350,000 gallons per day used for condensing.
December,		212,977	29,390,826	948,091	1,010	113,388	114,398	13,490		21.5	155.10	46.09	26	11	33,250,523	About 350,000 gallons per day used for condensing.
Totals and Averages July 1, 1874, to Jan. 1, 1875.	39,155	984,002	138,493,971	752,864	7,373	626,252	633,625	85,255	24	136.	152.68	46.10	24.37	11⅓	27,833,973	During the night the engine is only run often enough to keep water in the stand-pipe — generally about 30 revolutions per hour.

An Ordinance

To Provide for the Establishment of the Watuppa Water Board, and for the Care and Management of the Fall River Water Works.

Be it ordained by the City Council of the City of Fall River, as follows:

Sec. 1. A Board is hereby created for the care and management of the Fall River Water Works, which shall be known as the Watuppa Water Board.

Sec. 2. The Watuppa Water Board shall consist of three Trustees, all of whom shall be chosen from the citizens at large. No member of the city council shall be a member of the board.

Sec. 3. The members of the board shall be chosen in the month of April 1874, and shall enter upon the duties of the office on the ninth day of May 1874. One of the said board shall hold office for one year, one for two years, and one for three years from May 1st, 1874, or until others are chosen and qualified in their stead. There shall be chosen annually in the month of March after the year 1874, one member of said board who shall hold office for the term of three years from the first day of May following, or until another is chosen and qualified in his stead. The election of the members of said board shall be made by the city council in joint convention by ballot, and either of them may be removed at any time by the concurrent vote of the two branches. In case of a vacancy in said board from any cause, the city council shall, within thirty days after such vacancy, in like manner proceed to elect a successor for the residue of the term.

The members of said board, whose appointment and election are provided for in this ordinance, shall not enter upon the discharge of their duties, until the expiration of the term of service of the Water Commissioners chosen in accordance with the provisions of an act of the Legislature, entitled "An Act for supplying the City of Fall River with Pure Water," approved March 24th, 1871, which shall be on the eighth day of May of the present year; and previous to that date all the duties of the Watuppa Water Board, as set forth in this ordinance, shall be performed by the said Water Commissioners, who shall constitute said Water Board, and have during their continuance in office, all the authority conferred by this ordinance upon said board; and shall exercise the same, as fully as the members thereof, who shall be chosen in accordance with its provisions, and who are to constitute said board when the term of office of said Commissioners shall expire.

Sec. 4. The Officers of the board shall be a President and a Clerk, who shall be chosen by the members thereof by ballot. The Clerk shall not be a member of the board.

Sec. 5. A Superintendent shall be appointed by the board, who, with the clerk thereof, and all such subordinate officers, agents and assistants as may be found necessary, and which said board is hereby authorized to appoint, shall hold their respective offices or situations during its pleasure; shall perform such duties, respectively, as the board shall assign; and receive such compensation as the board, in the absence of any order of the city council in relation thereto, shall determine.

Sec. 6. The Clerk of the Board shall be Water Registrar; and may employ such assistance as may be necessary in this department of his duties, subject, in all matters of appointment and compensation, to the action of the Water Board.

Sec. 7. The Watuppa Water Board shall have and exercise all the powers vested in the City Council by "An Act for supplying the city of Fall River with Pure Water," approved March 24th, 1871, and any acts in addition thereto, so far as the same can be legally delegated.

Sec. 8. The President of the board shall exercise a general supervision over the Water Works, the materials and property connected therewith, and over all subordinate officers and agents. He shall preside at all meetings of the board, and in his absence a President *pro tem.* shall be chosen.

Sec. 9. The Clerk shall be the recording officer of the board, and shall be sworn to the faithful performance of his duties. He shall have the custody and supervision of all the books, plans and documents under the control of the board, and shall keep all such books and records as the board shall direct.

Sec. 10. The Superintendent shall have charge of the aqueduct, lands, reservoirs, buildings, engines, and all other property connected with the water works, subject in all matters in relation thereto to the control, and directions of the board; and he shall perform all such services in connection with said works as may, by the board, be required of him.

Sec. 11. The Water Registrar shall have the charge, under the direction of the board, of all matters connected with the delivery of the water and the payment therefor; and shall see that all the rules and regulations of the board or the City Council in relation to the use of the water are observed, and all the penalties for their violation enforced. For this purpose he shall every year, and as much oftener as he may be directed by the board, or may himself think proper, personally, or by an assistant under his direction, visit the premises of every person who takes the water, and in all suitable ways exercise a constant and careful supervision over its use.

The Registrar shall keep suitable books, in which shall be entered the names of all persons who take the water; the kind of building; the name of the street and the number of the building; the nature of the use; the number of taps and the amount charged; and he shall prepare and put into use all such forms as may be approved by the board, and which may be found necessary for the prompt and reliable discharge of the duties of his office. He shall forthwith report to the board all failures on the part of water takers to meet the demands made upon them, shall execute all decisions of the board in relation to the

letting on or cutting off of the water, and under its control may make abatements in the water rents in all proper cases.

Sec. 12. The water board shall determine and assess the water rates according to the tariff of rates adopted by the city council, including the water used by individuals, corporations, and by the city for fire and other purposes, a copy of which assessments, certified by the Clerk of the board, shall be placed in the hands of the Water Registrar, for his direction in the discharge of his duties.

Sec. 13. The money received by the Clerk of the water board, in his capacity of Water Registrar, shall be paid by him to the City Treasurer, and by the City Treasurer placed to the credit of the Fall River Water Works.

Sec. 14. All demands against the city for account of the Water Works, shall be examined by the board. A list of such as may be approved shall be prepared by the Clerk, and certified by him and the President. This list, with the bills and rolls included in it, shall be laid before the "Joint Standing Committee on Water Works" of the city council for its action thereon. The aggregate, only, of the list of demands presented and allowed shall be entered upon the records of the City Auditor; and the bills with the list properly certified by the committee, shall be placed in the hands of the City Treasurer for payment.

Sec. 15. The receipts into the treasury from water rents, shall be appropriated as follows:

First, To the payment of the expenses of the management and repairs of the works.

Second, To the payment of the interest on the water loan.

Third, For such extensions not exceeding two thousand feet in one year, as may be ordered by the Water Board.

Fourth, To the payment of the principal of the water loan.

And it shall be the duty of the City Treasurer to apply the receipts into the treasury from the water rents to these several purposes in the order in which they are herein named; *provided, however*, that if a specific sum shall be appropriated by

the City Council, for the necessary repairs, extensions or improvements of the works, and the payment of the officers, agents, clerks and assistants connected therewith, no expenditure for these purposes shall be made or authorized by the board, in excess of such appropriations, without the further action of the Council.

Sec. 16. The Superintendent of the works, shall, some time during the second week in January, annually, lay before the board a report of the general condition of the works, a detailed statement of all expenditures in his department, and of all such other matters and things in connection therewith as he may deem necessary, or in relation to which he may be specifically instructed by the board.

Sec. 17. The Watuppa Water Board shall, on some day during the month of January, annually, place in the hands of the Mayor a report to the City Council; which report shall contain, in addition to the report to the Board from the Superintendent, a full statement of the operations of the Board, and a detailed account of the receipts and expenditures for the year ending on the last day of December next preceding.

Also a statement setting forth the cost of each branch of the works up to that time, and a schedule of the lands and other property belonging to the city and connected with the works. And it shall be the duty of the Board in their annual report, to lay before the City Council all such information, and to make all such suggestions as may be deemed needful in connection with the condition and operation of the works.

Sec. 18. No member of the Water Board, or any person appointed to any office or employed under the provisions of this ordinance, or any act of the General Court in relation to the Fall River Water Works, shall be directly or indirectly interested in any contract, bargain, sale, or agreement in relation to the same, or connected therewith, wherein the city is interested; and all contracts, bargains, sales or agreements made in violation of this section, shall be utterly void as to the city.

Sec. 19. Any person who shall injure any public conduit, pipe or reservoir, connected with the Fall River Water Works,

or who shall break and enter the same, or draw off, or cause to be drawn off any of the water therefrom, or shall turn on or off the water in any such water-pipe, conduit or reservoir, or shall make any opening or connection with such pipe, conduit or reservoir, without the license or authority of the Water Board, or shall remove the cover of any hydrant, except in case of fire or by the authority of the Water Board, or of the Chief Engineer of the Fire Department, shall forfeit and pay for each offence a sum not less than three or more than twenty dollars; provided, however, that nothing in this section shall be construed as in any way affecting the operation of the seventeenth and eighteenth sections of the "Act for supplying the City of Fall River with Pure Water" approved March 24th, 1871.

Sec. 20. All property, real or personal, appertaining to the Fall River Water Works, and under the control of the Water Board, may be disposed of by said Board; it being understood that all conveyances under seal shall be in the manner provided by law, with the addition of the signature of the President of the Board.

Sec. 21. The Water Board shall have power to establish such regulations, not conflicting with the regulations established by this Ordinance, as it may deem expedient for the introduction and use of the water; and the water shall not be supplied for any purpose unless the pipes and fixtures shall be constructed and arranged in conformity with said regulations.

Sec. 22. The following regulations are hereby established, and shall be considered a part of the contract with every person who takes the water, and the fact of taking shall be considered as expressing assent on the part of the taker to be bound thereby.

They shall be printed upon every bill of water rent; and whenever any one of them is violated, although two or more parties may receive the water through the same faucet, the water shall be cut off, and shall not be let on again except by order of the Water Board, and on the payment of two (2) dollars; and in case of any such violation, the Water Board shall have the right to declare any payment made for the water, by

the person committing such violation, to be forfeited, and thereupon the same shall be forfeited.

REGULATIONS.

I All persons taking the water shall keep the service pipes within their premises in good repair, and protected from frost at their own expense; and they shall be held liable for all damage which may result from their failure to do so.

II Care shall be taken to prevent any unnecessary waste of water, and there shall be no concealment of the purposes for which the water is used.

III No alteration shall be made in any of the pipes or fixtures inserted by the city, except by its agents, who are to be allowed to enter the premises supplied, to examine the apparatus, and to ascertain whether there is any unnecessary waste; and no alteration or extension of the pipes in the house shall be made without notice to the Superintendent.

IV. No water shall be supplied to parties not entitled to the use of it under the City Ordinance, unless by special permission.

V. The Water Registrar and Superintendent, and any Agents or Assistants, with them or under their directions, may enter the premises of any water taker to examine the quantity used and the manner of its use; and to cut off the water for non-payment of rents or fines, or any violations of these regulations; or for any other necessary purpose connected with the discharge of their respective duties under this ordinance or any regulations of the Water Board.

VI. All service pipes and stop cocks will be supplied and put down to the street line, by the city. All work beyond the street line shall be done under the direction and approval of the Water Board, by the water taker, and at the expense thereof, both for labor and materials.

Sec. 23. The occupant of any premises where an unnecessary waste of water occurs, shall be liable to a fine of two dollars for the first offence, and four dollars for the second of-

fence during the same year, and shall be notified in writing; and if such waste shall not be prevented and the fine aforesaid paid within two days from the time when said notice is given, the water shall be cut off from the said premises, and shall not be again let on for the same occupant until the waste be stopped and the fine paid, together with an additional sum of two dollars, for cutting off and letting on the water; and in case of a third or subsequent offence, the water shall be cut off and shall not again be let on except by a vote of the board and the payment of such fine, not exceeding ten dollars, as the board may impose.

Sec. 24. In all cases of the non-payment of the water rent for fifteen days after the same is due, the Water Registrar shall cause the supply of water to be cut off, and the water shall not be again let on, except upon the payment of the sum of two dollars, and not for the same occupant or owner, except upon the payment also of the whole amount due; *provided*, that in case of specific supplies or for fractional parts of the year, where the water has been let on, it may be cut off immediately after notice given at the place that the rent is not paid, and may be let on again upon the condition above mentioned.

Unless the Water Board shall otherwise direct, the foregoing provisions shall apply when two or more parties take the water through the same faucet, although one or more may have paid the proportion due from him or them.

Sec. 25. The annual rent for the use of the water shall be payable in advance on the first day of July of each year. All charges for specific supplies or for fractional parts of the year, shall be payable in advance and before the water is let on; and in all cases where the consumption of water is ascertained by meters, gauge, or estimate of the Water Board, the bills shall be rendered quarterly; and such bills shall be paid within ten days thereafter.

Sec. 26. Occupants and owners of tenements will be held to their respective obligations according to law. When several tenants are supplied with water by a service or supply pipe in common, the water from which is measuerd by meter or gauge, each tenant shall be held responsible for the payment of a pro-

portional amount of the whole assessment, according to the fixtures in use by each, unless the whole amount is paid by the landlord.

In all cases where water is supplied under such circumstances, the landlord shall be notified of his liability for the payment for the water used on his premises, which notice shall be renewed annually, unless such arrangement shall be made as will render such notice unnecessary.

In Common Council March 30th, 1874.

Passed to be ordained.

CRAWFORD E. LINDSEY, Prest.

In Board of Aldermen March 30th, 1874.

Passed to be ordained.

JAS. F. DAVENPORT, Prest.

Fall River, March 30th, 1874.

Approved.

JAS. F. DAVENPORT, MAYOR.

An Ordinance

ESTABLISHING THE WATER RATES OF THE FALL RIVER WATER WORKS.

Be it ordained by the City Council of the City of Fall River, as follows:

Sec. 1. The following rates are established for the water supplied by the Fall River Water Works, all the charges being annual, unless otherwise expressed in connection with the item of charge.

DWELLING HOUSES.

Occupied by one family,	
for the first faucet,	$5 00
for each additional faucet,	2 50
Two or three families occupying one house,	
one faucet for all, each family,	3 50
one faucet for each family, each faucet,	5 00
for each additional faucet,	2 50
Four or more families occupying one house,	
one faucet for all, each family,	3 00
one faucet for each family, each faucet,	5 00
for each additional faucet,	2 50
For the first bath-tub,	5 00
For each additional bath-tub,	4 00
For the first pan or self-acting water-closet,	5 00
For each additional pan or self-acting water-closet,	3 00
For each hopper water-closet,	8 00
For each self-closing urinal,	2 00

When two faucets are used emptying into one vessel, one for hot and one for cold water, only one charge will be made for both, and the same rule will apply to boarding houses.

Provided, That in no case shall the charge for the use of water by a private family, exceed without a hopper water-closet $22 00, or with a hopper water-closet $26 00.

BOARDING HOUSES.

For the first faucet,	$10 00
For each additional faucet,	2 50
For the first pan or self-acting water-closet,	10 00
For each additional pan or self-acting water-closet,	3 00
For a hopper water-closet,	15 00
For a self-closing urinal,	3 00
For a bath-tub for boarders' use,	10 00

HOTELS.

For each bed for boarders and lodgers,	2 00
For the first pan or self-acting water-closet,	10 00
For each additional pan or self-acting water-closet,	3 00
For each bath-tub,	10 00
For each self-closing urinal,	3 00

STORES, OFFICES, &c.

For each tenement occupied as a store, office, shop, warehouse, or for purposes not included in any other classification, and not requiring more than an ordinary supply of water,

For the first faucet,	5 00
For each additional faucet,	2 50
For two or more tenements supplied from one faucet, each tenement,	4 00
For a pan or self-acting water-closet, or a self-closing urinal, used by the occupants of one tenement only,	
For water-closet,	5 00
For urinal,	2 50
Used by the occupants of two or more tenements for water-closet, each tenement,	4 00
for urinal, for each tenement,	2 00

PRIVATE STABLES.

For the first horse,	4 00
For each additional horse,	2 00
For each ox or cow,	1 00

LIVERY, CLUB, BOARDING, AND OMNIBUS STABLES.

For not exceeding five horses, the same as private stables,	
For each additional horse in excess of five,	1 50

TRUCK AND CART STABLES.

For the first horse,	4 00
For each additional horse,	1 25
The above rates for stables include water for washing carriages and omnibuses *without hose*.	
For the use of hose in any stable,	
For the first horse,	8 00
For each additional horse,	50

HOSE.

For the use of hose for washing windows, sprinkling streets, or watering gardens, the use to be limited to one hour per day,	
For nozzle not exceeding $\frac{3}{4}$ inch diameter,	6 00
For nozzle not exceeding $\frac{5}{8}$ inch in diameter,	10 00
No charge will be made for the right to insert a pipe, at the expense of the water-taker, to be used in case of fire only.	

PUBLIC BATHS.

For each tub in a public bath-house,	$10 00
For each pan or self-acting water-closet in a public bath-house,	10 00

BUILDING PURPOSES.

For each cask of lime or cement used,	06

MANUFACTURING AND OTHER PURPOSES.

For measured or estimated water per 100 gallons.	03
Provided that no charge for measured or estimated water shall be less than ten (10) dollars per annum.	

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NON-ENUMERATED PURPOSES.

Sec. 2. For the use of the water, in all cases not herein enumerated, the rates shall be fixed by the Water Board as near as may be in accordance with the rates hereby established; which rates, so determined, shall be binding upon all parties as fully as if herein designated.

USE OF METERS.

Sec. 3. The Water Board may, in all cases, ascertain by Meters the quantity of water used; and water-meters, to be approved by the Water Board, may be placed upon the premises of any owners or occupants at their own expense, for the purpose of measuring the quantity of water by them used respectively. And when, in any case, the quantity shall be thus ascertained, the rates shall be charged as set forth under the head of "Manufacturing and other purposes." No Meter shall be used but such as shall be approved by the Board.

USE OF WATER BY THE CITY.

Sec. 4. The City Council shall annually make an appropriation of Twenty Thousand Dollars as a full equivalent for the unlimited use of water by the city for all public purposes, including all that may be necessary for the extinguishment of fires, sprinkling of streets, supplying public fountains and drinking accommodations when desirable, and its use in the public buildings including the school-houses and the city stables. Said sum of twenty thousand dollars shall be placed by the city Treasurer to the credit of the Fall River Water Works.

In Common Council March 30th, 1874.

Passed to be ordained.

CRAWFORD E. LINDSEY, Prest.

In Board of Aldermen March 30th, 1874.

Passed to be ordained.

JAS. F. DAVENPORT, Prest.

Fall River, March 30th, 1874.

Approved.

JAS. F. DAVENPORT, MAYOR.